Артоболевский И. И.

Механизмы в современной технике

Том V

ИЗДАТЕЛЬСТВО «НАУКА»
МОСКВА

MECHANISMS in Modern Engineering Design

A Handbook for Engineers, Designers and Inventors

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Volume V

Hydraulic, Pneumatic and Electric Mechanisms

Part 2

Electric Mechanisms

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CONTENTS

PREFACE

This fifth and concluding volume of *Mechanisms in Modern Engineering Design*, published in two parts, deals with mechanisms based on hydraulic, pneumatic and electric devices. The first two types are presented in Part 1 and the third in Part 2. The mechanisms are accompanied by pertinent descriptions of their structure and the motions they perform. Data are given for certain of the mechanisms on the kinematic and dimensional relations of their links, etc. The schematic representations of the mechanisms are, so far as is practicable, in the same form as in the first four volumes. But, owing to specific features, it was found expedient to alter the methods for describing and depicting certain of the items.

These mechanisms have been systemized, as they were in the first four volumes, on the basis of their structural features, with a second classification—based on their service function—given parallel to the first classification.

Two tables given in Part 1 of Volume V, similar to those at the beginning of Volumes I, III and IV, enable the reader to readily locate the required mechanism, either by its structural features or by its service function. The mechanisms are additionally listed in alphabetical order in the subject index at the back of each part of Volume V. The indices of the subgroups are the same as in the first four volumes, but they have been supplemented by new subgroups given for the first time in the present volume.

The reader can find all the necessary information on how this handbook can be most efficiently used, on the conventions followed in the schematic representations and the descriptions, as well as on other matters of this nature, in the preface and introduction published in the first volume.

Grateful acknowledgement is made of the assistance of the staff of the Theory of Machines and Mechanisms Department, USSR Polytechnical Correspondence Institute. Especial thanks are due to the Science Editor, N. V. Speransky, Cand.Sc.(Eng.) for his participation in preparing this and the preceding volumes for publication, and to E. V. Hertz, D.Sc. (Eng.) for her expert consultation and competent advice, and for all the material she so kindly made available.

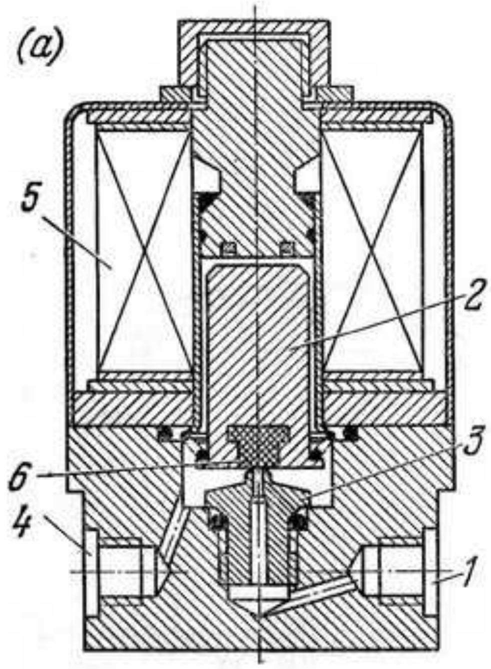
I. I. Artobolevsky
(1905-1977)

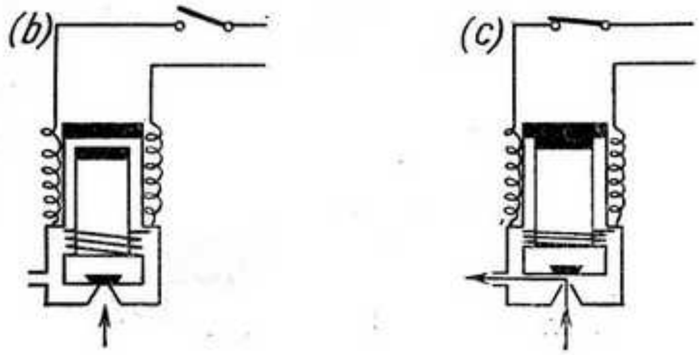
SECTION THIRTY-THREE

Simple Electric Mechanisms SmE

1. FLOW-CONTROL AND DIRECTIONAL VALVE MECHANISMS (4311 through 4320)

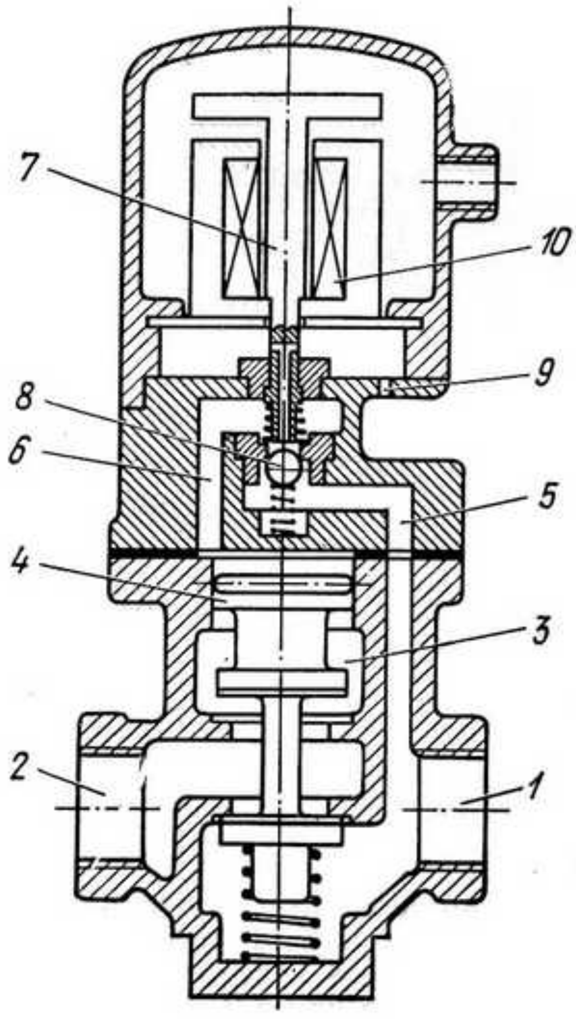
4311	TWO-WAY TWO-POSITION PLUNGER-TYPE SOLENOID-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC





Compressed air is delivered from the mains to port *1* of the valve (Fig. *a*). Plunger *2* is held by a spring in the position shown and rubber insert *6* closes the passage in pipe connection *3*. When coil *5* is energized plunger *2* is pulled into the coil and opens the passage for air from port *1* to port *4* through connection *3*. The principle of the valve is shown schematically in Figs. *b* and *c*.

4312	THREE-WAY TWO-POSITION PLUNGER-TYPE SINGLE-SOLENOID PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC



4312

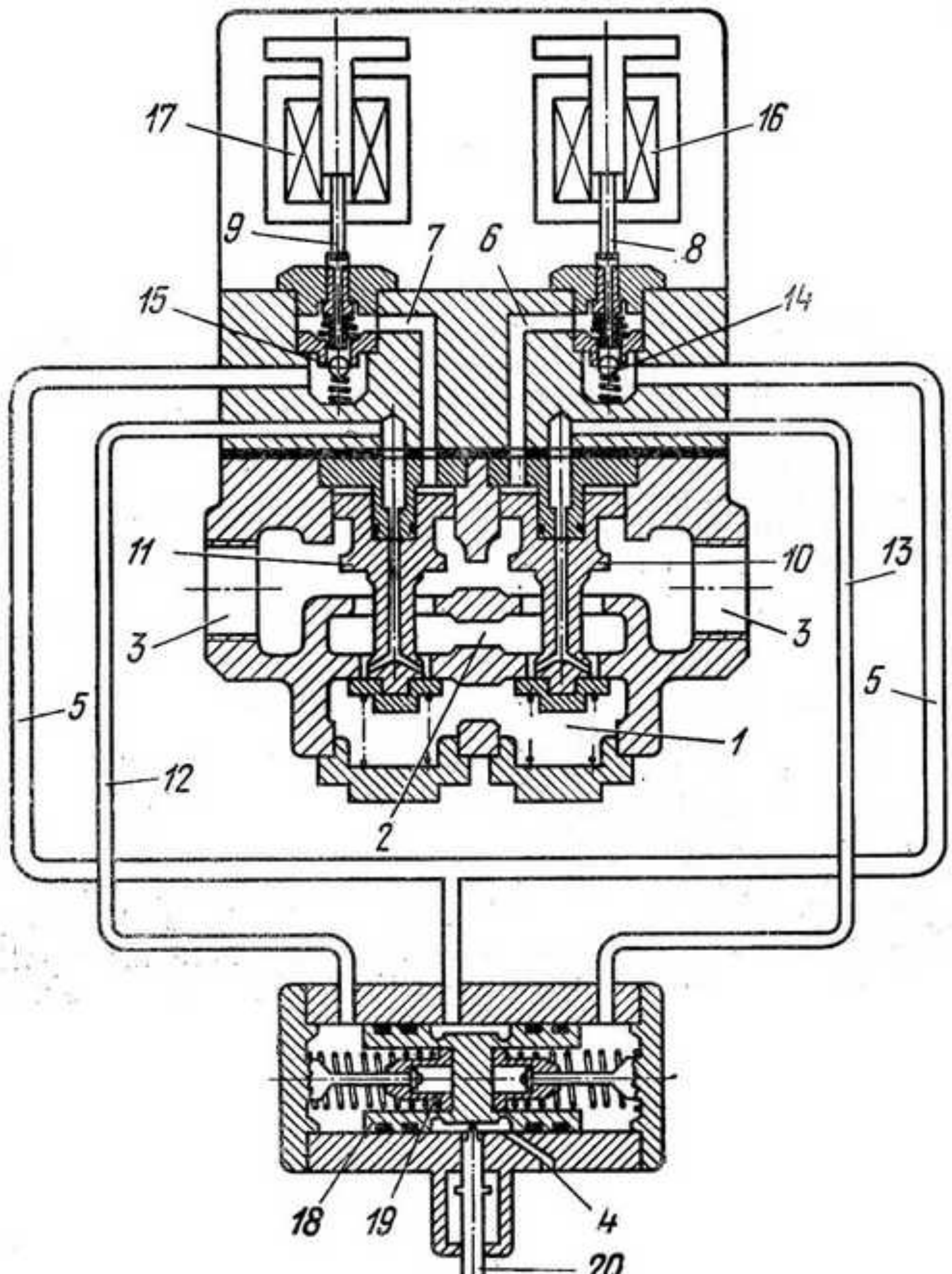
THREE-WAY TWO-POSITION PLUNGER-TYPE SINGLE-SOLENOID PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM

SmE

FC

Compressed air is delivered from the mains to port *1*. Port *2* is connected to chamber *3* which, in turn, is connected to the atmosphere by a port (not shown). At the same time, air is delivered through channel *5* to ball valve *8*. Channel *6* is connected to the atmosphere through holes drilled in armature *7* and through hole *9*. When coil *10* is energized, the armature is pulled into the electromagnet and moves downward, overcoming the resistance of the spring. In the first part of this motion, the ball of valve *8* shuts off the central passage in the armature, disconnecting channel *6* from the atmosphere. In further motion of the armature, the ball of valve *8* is pushed downward, allowing air from channel *5* to enter channel *6*. The pressure of the compressed air shifts plunger *4* downward, overcoming the resistance of the spring, and air from port *1* flows through port *2*, which is disconnected from chamber *3*. When coil *10* of the electromagnet is de-energized, armature *7* is raised by its spring, ball valve *8* closes and channel *6* is connected to the atmosphere. Then plunger *4* is returned by its spring to the position shown. Directional valves of this type are applied to control one-way actuators (operating cylinders or devices).

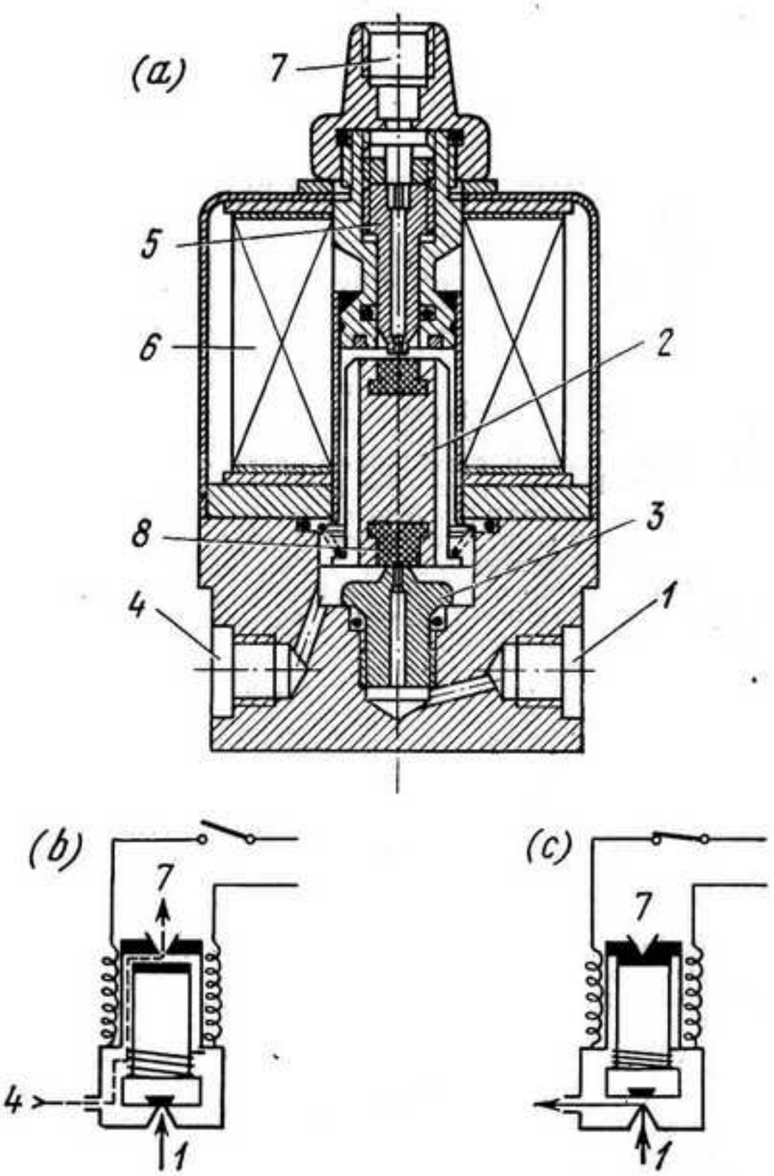
4313	TWO-POSITION PLUNGER-TYPE DOUBLE-SOLENOID PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC



4313	TWO-POSITION PLUNGER-TYPE DOUBLE-SOLENOID PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC

Compressed air is delivered from the mains to chamber *1* through a port (not shown), and the outlet of the valve is chamber *2*, which is connected to the actuator (operating cylinder or device). In the OFF position, chamber *2* is connected to the atmosphere through two ports *3*. Besides, air from the mains is delivered to port *4* by a special directional valve. This air flows further through pipelines *5* to the outlets of two three-way solenoid-operated pilot valves. When the magnet coils *16* and *17* are de-energized, armatures *8* and *9* are held by springs in the position shown. Channels *6* and *7* are connected to the atmosphere through holes drilled in armatures *8* and *9*. Consequently, plungers *10* and *11* are held by springs in the positions shown. Magnet coils *16* and *17* are connected in parallel; when their electric circuit is closed, they operate simultaneously. Armatures *8* and *9* move downward so that balls *14* and *15* first shut off the central passages in the armatures leading to the atmosphere and then are pushed downward. This admits air from pipelines *5* into channels *6* and *7*. The pressure of the compressed air shifts plungers *10* and *11* downward, disconnecting chamber *2* from ports *3*, leading to the atmosphere, and connecting it to chamber *1*. Compressed air from chamber *1* is admitted into chamber *2*. If one of the plungers, *10* or *11*, does not operate as a result of some defect, for instance, if a coil winding is burnt out or a pilot valve gets out of order or the plunger itself is jammed, the air pressure does not increase at outlet *2* of the directional valve. The reason for this is that the area of the openings connecting chambers *1* and *2* is considerably less than that of the opening leading from chamber *2* to the atmosphere. All the air admitted by the properly operating pilot valve is released to the atmosphere through the malfunctioning pilot valve. Air passing through the openings connecting chambers *1* and *2* is admitted through the internal passages in plungers *10* and *11* into pipelines *13* and *12*. If only one of the pilot valves has operated properly, and the other has not functioned, the pressure in one of these passages is equal to that in the mains and the pressure in the other passage is atmospheric. Air pressure shifts a plunger *18* of the special pilot valve, moving a sleeve *19* and overcoming the resistance of the corresponding spring. After plunger *18* has been shifted, air delivery ceases through pipelines *5* to the inlets of the pilot valves, and plunger *18* is held in the shifted position by locking member *20*. Hence, if one of the pilot valves gets out of order, the air delivered through the other pilot valve is discharged to the atmosphere, after which this second valve closes. Member *20* must be manually retracted to start the system again. The provision of two pilot valves operating in parallel and the device controlling their simultaneous operation enables the reliability of the control system to be substantially improved.

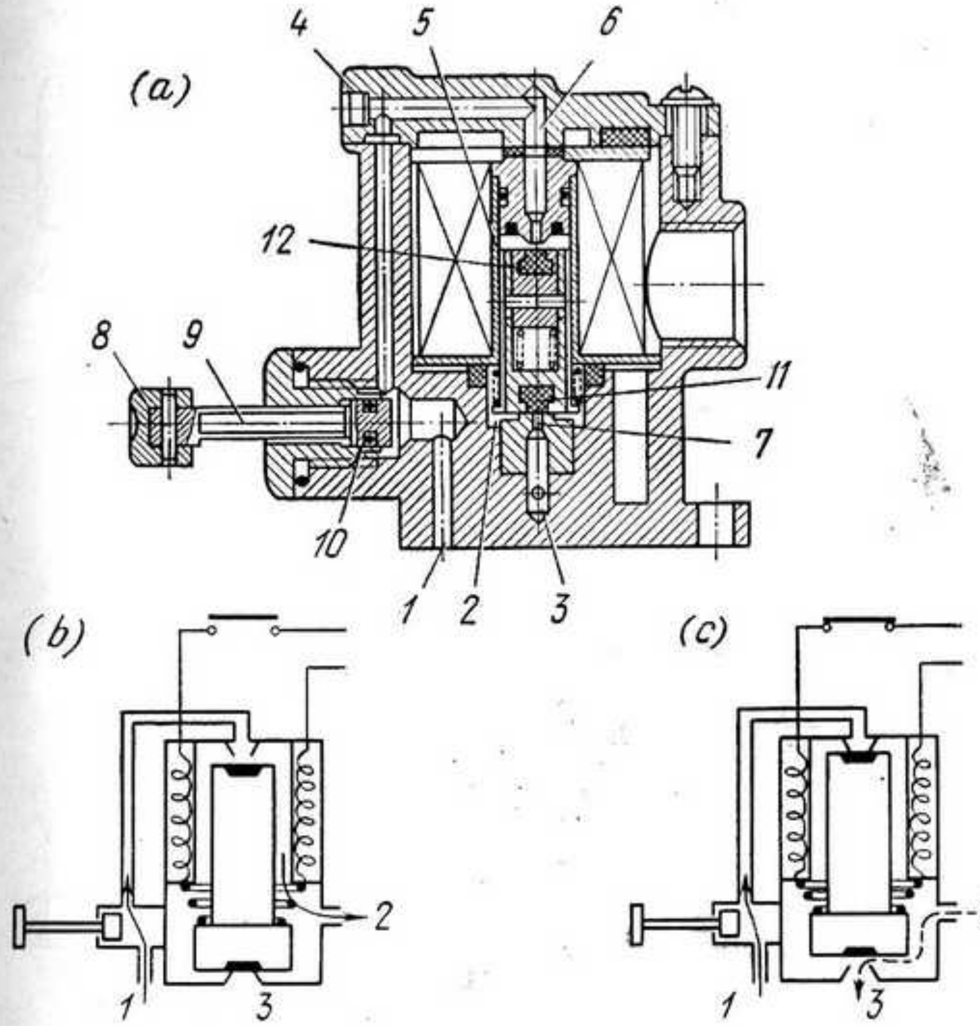
4314	THREE-WAY TWO-POSITION PLUNGER-TYPE SOLENOID-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC



Compressed air is delivered from the mains to port *1*, and the outlet of the valve is port *4*. If magnet coil *6* is de-energized, plunger *2* is held by a spring in the position shown in Fig. *a*, in which rubber insert *8* closes the passage in pipe connection *3*. Outlet port *4* is connected through slots in plunger *2* and the central hole in sleeve *5* to port *7*, which leads to the atmosphere. When magnet coil *6* is energized, plunger *2* overcomes the resistance of the spring and is shifted to its upper position, in which the upper rubber insert closes the hole in sleeve *5*. This also opens the passage in pipe connection *3*. Air from port *1* is discharged through port *4*.

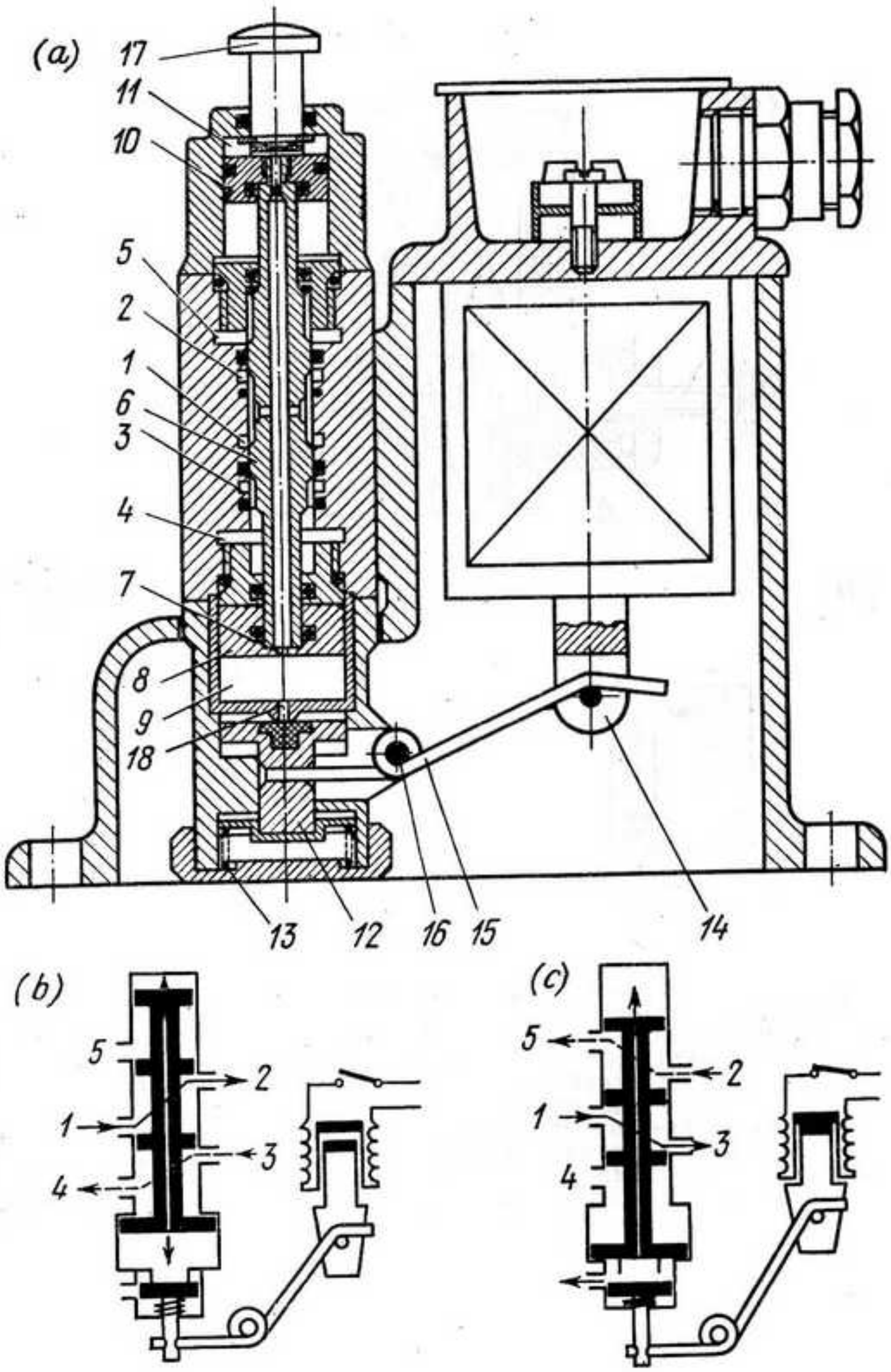
The principle of the valve is shown schematically in Figs. *b* and *c*.

4315	THREE-WAY TWO-POSITION PLUNGER-TYPE SOLENOID-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC



Compressed air is delivered from the mains to port *1*, from where it passes through hole *6* in cover *4* and slots in plunger *5* to chamber *2*, which is connected to the valve outlet. When the electromagnet is energized, plunger *5* moves upward and rubber insert *12* closes hole *6*. At the same time, second rubber insert *11* opens hole *7*, connecting the valve outlet to port *3*, which leads to the atmosphere. When the magnet coil is de-energized, plunger *5* is returned by its spring to the position shown in Fig. *a*. The valve has additional manual controls, used in setting it up and in eliminating trouble. When knob *8* is pushed inward, it shifts plunger *10*, closing the passage of air from port *1*. This connects chamber *2* to the atmosphere through slots in stem *9*. The principle of the valve is shown schematically in Figs. *b* and *c*.

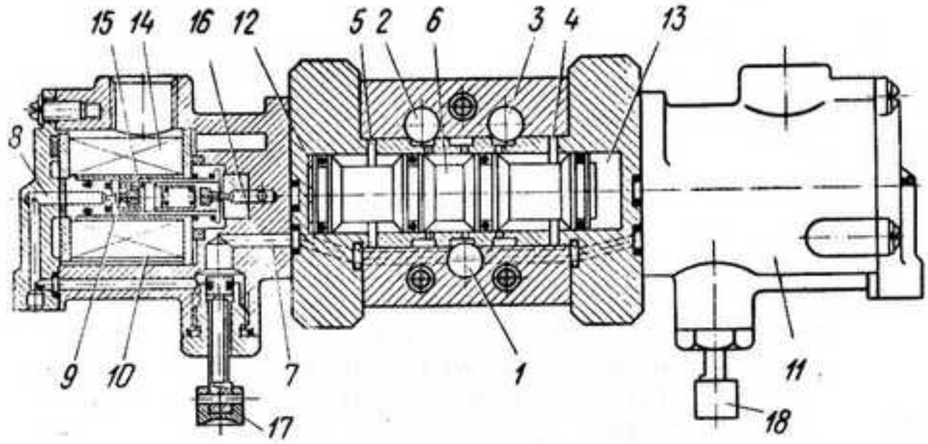
4316	FIVE-WAY TWO-POSITION SPOOL-TYPE SINGLE-SOLENOID PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC



4316 | **FIVE-WAY TWO-POSITION SPOOL-TYPE SINGLE-SOLENOID PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM** | SmE FC

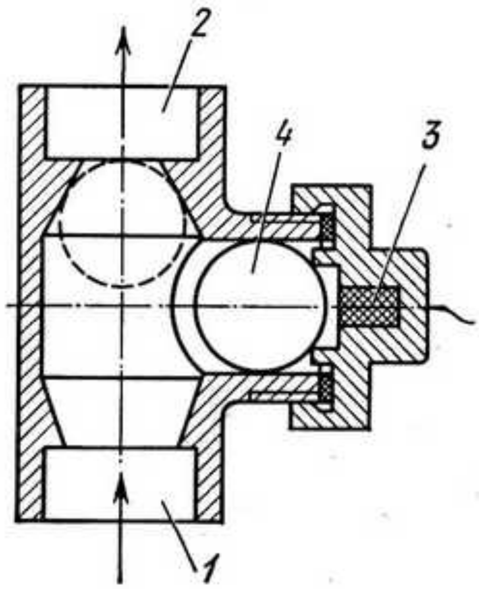
Compressed air is delivered into chamber *1* from where it flows to chamber *2* and to chambers *9* and *11*. Outlet *3* of the valve is connected to chamber *4*, which leads to the atmosphere. The difference in forces acting on plungers *8* and *10*, due to their different diameters, holds spool *6* in the position shown in Fig. *a*. When the magnet coil is energized, armature *14* is pulled upward, turning lever *15* counterclockwise about fixed axis *16*. This moves plunger *12* downward, overcoming the resistance of spring *13* and opening holes *18* and 7. The pressure in chamber *9* drops practically to atmospheric pressure, while that in chamber *11* is maintained constant. This shifts valve spool *6* downward. After this, air from the mains is delivered into chamber *3*, and chamber *2* is connected to chamber *5*, which leads to the atmosphere. When the coil is de-energized, hole *18* is closed and the valve spool returns to the position shown in Fig. *a*. The spool can also be shifted manually by means of knob *17*. The principle of the valve is shown schematically in Figs. *b* and *c*.

4317	FIVE-WAY TWO-POSITION SPOOL-TYPE DOUBLE-SOLENOID PILOT-OPERATED PNEUMATIC DIRECTIONAL VALVE MECHANISM	SmE FC



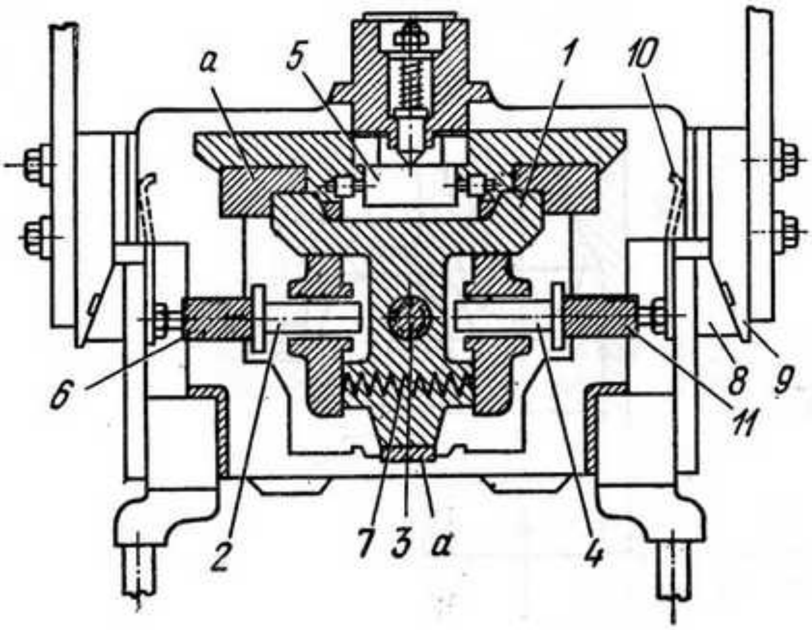
Compressed air is delivered from the mains to port *1*. In the position of spool *6* shown, the air passes to port *2*, which is connected to the actuator (operating cylinder or device). Port *3* is connected to port *4*, which leads to the atmosphere. At the same time, air passes through channel 7 to holes *8* of two solenoid-operated pilot valves *10* and *11*. If the coils of the pilot valves are de-energized, air from holes *8* passes through chamber *9*, the slots in plunger *15* and internal channels to ends *12* and *13* of the valve spool. Since the pressure is the same at both ends of valve spool *6*, it remains in the position shown. When coil *14* of pilot valve *11* (not sectioned) is energized, its plunger *15* is pulled into the coil so that it closes hole *8* and opens hole *16*, which leads to the atmosphere. Thus, chamber *9* of pilot valve *11* and, consequently, end *13* of spool *6* are connected to the atmosphere. The pressure at end *12* of spool *6* remains constant and shifts the spool to the right. This connects port *1* to port *3*, and port *2* to port *5*, which leads to the atmosphere. To return spool *6* to its initial position, it is necessary to energize the coil of pilot valve *10* and to de-energize the coil of pilot valve *11*. Knobs *17* and *18* enable the valve to be manually controlled in setting up or in case of failure of the electrical control system.

4318	TWO-WAY BALL-TYPE ELECTRICALLY OPERATED SHUTOFF VALVE MECHANISM	SmE FC



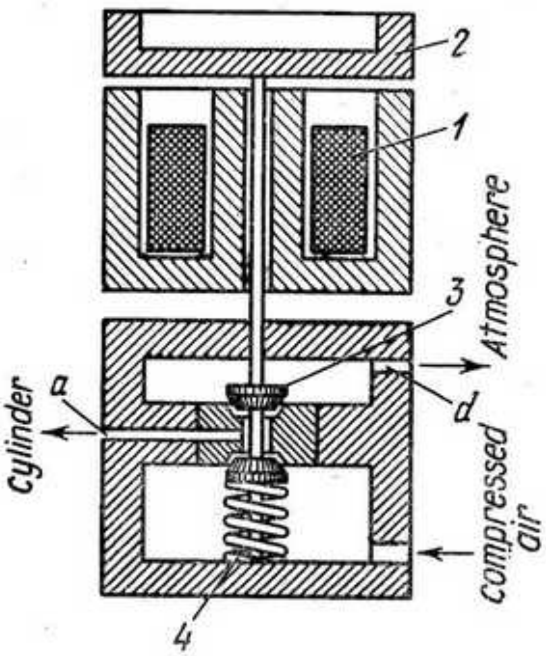
Fluid (air or liquid) is delivered to port *1* from where it flows to outlet port *2*. When a pulse of electric current is received, powder charge *3* is fired and ball *4* is thrown out of its seat so that it closes the passage to port *2*. This shutoff valve is employed for artillery piece control.

4319	CURRENT DISTRIBUTOR MECHANISM	SmE FC



Carriage *1* is traversed in the direction perpendicular to the plane of the drawing in guides *a* when screw *3* rotates. Mounted on carriage *1* are three rollers, *2*, *4* and *5*. Rollers *2* and *4* close the contacts in the secondary circuit, and roller *5* switches on the timer that controls the welding current impulse time. As carriage *1* travels, rollers *2* and *4*, actuated by spring *7*, press pins *6* and *11*, closing contacts *8* and *9*. The contacts are retracted by springs *10* when rollers *2* and *4* pass on to the next pins.

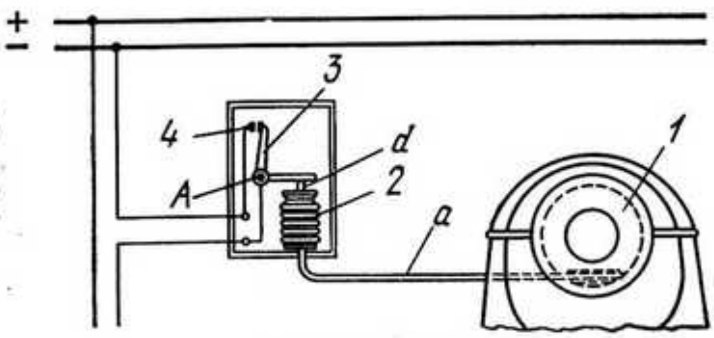
4320	POPPET-TYPE SOLENOID-OPERATED VALVE MECHANISM	SmE FC



When coil *1* of the solenoid-operated valve is energized, armature *2* is pulled downward, lowering valve member *3* and connecting port *a*, leading to the actuating cylinder, to the compressed air tank. When coil *1* is de-energized, spring *4* lifts valve member *3*, connecting port *a* to the atmosphere through port *d*. In the drawing, the armature is shown in its middle position.

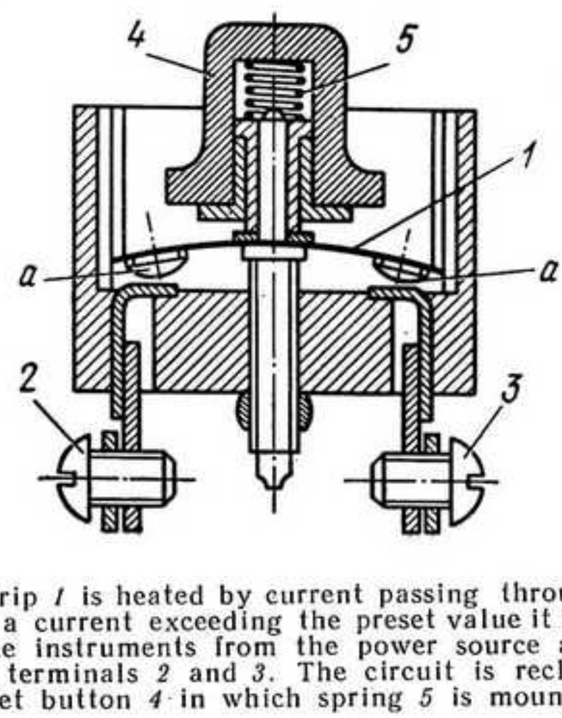
2. RELAY MECHANISMS (4321 through 4334)

4321	THERMAL PROTECTIVE RELAY MECHANISM	SmE Re



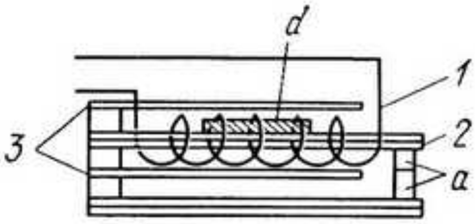
The sensitive element of the relay consists of narrow cylinder *1* inserted into the bearing (if the relay is used to protect the bearings from overheating). This cylinder is filled with a liquid and is connected by tube *a* to bellows *2*. When bellows *2* is expanded by the heated and expanded liquid that fills cylinder *1*, pin *d*, secured to the bellows, turns lever *3* counterclockwise about fixed axis *A*. This closes contacts *4* and transmits a signal indicating that the bearing is overheated.

4322	BIMETALLIC-STRIP THERMAL CUTOUT MECHANISM	SmE Re



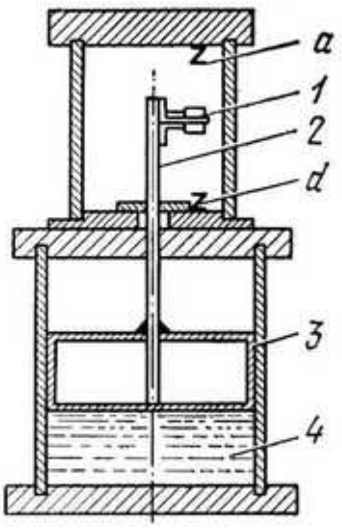
As bimetallic strip *1* is heated by current passing through it, it is deformed, and at a current exceeding the preset value it breaks contacts *a*, switching off the instruments from the power source and breaking the circuit between terminals *2* and *3*. The circuit is reclosed by pressing reset button *4* in which spring *5* is mounted.

4323	BIMETALLIC-STRIP THERMAL TIME RELAY MECHANISM	SmE Re



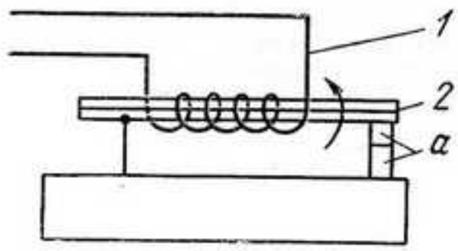
When winding *1* is energized, bimetallic strip *2* bends upwards and opens contacts *a*. Contacts *a* open with a definite time delay that is controlled by copper strip *d*. Strip *d* varies the heat capacity of the system. Strips *3* prevent dissipation of thermal energy.

4324	FLOAT-TYPE RELAY MECHANISM	SmE Re



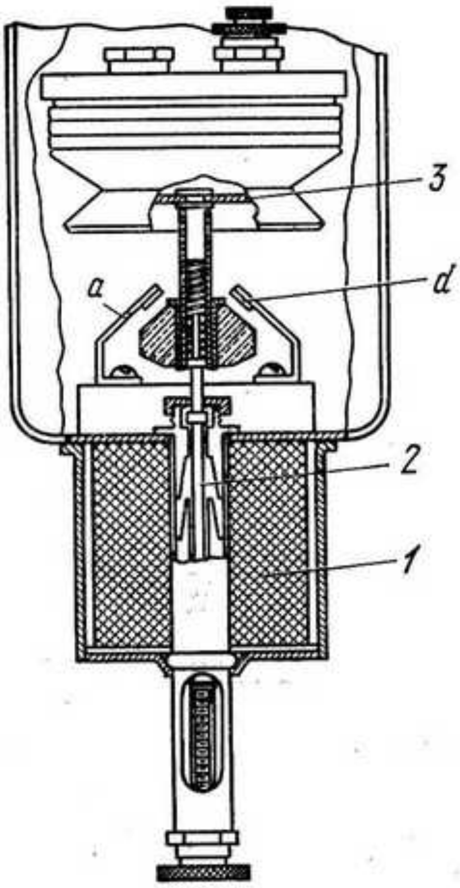
The position of contact bridge *1*, mounted on rod *2* of float *3*, depends upon the liquid level in tank *4*. At the upper limiting liquid level in tank *4*, contact bridge *1* rises together with float *3*, closing the circuit at upper contact *a*. At the lower limiting liquid level in the tank, the circuit is closed at lower contact *d*. The relay is regulated to different ranges of variation of the liquid level by changing the distance between contacts *a* and *d*.

BIMETALLIC-STRIP THERMAL PROTECTIVE RELAY MECHANISM



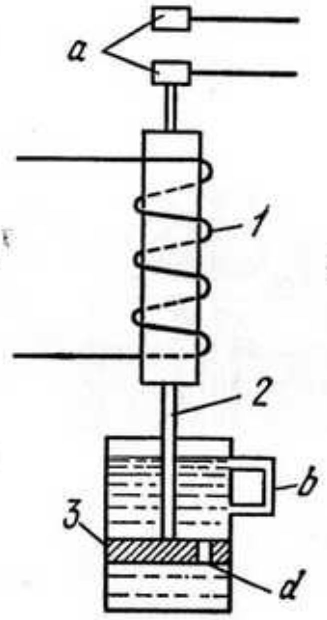
When the current in winding *1* exceeds the preset value, bimetallic strip *2*, heated by the current, bends upward and opens contacts *a*.

4326	SOLENOID-OPERATED PNEUMATIC TIME RELAY MECHANISM	SmE Re



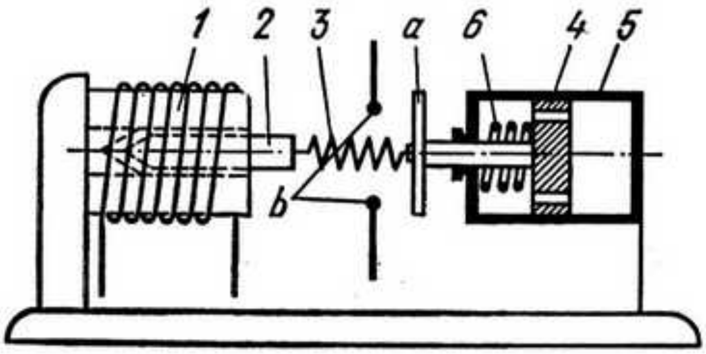
Linked to armature *2* of solenoid *1* is piston *3* which travels in a cylinder having a flow-control valve. When solenoid *1* is energized, piston *3* rises and forces the air out of the cylinder through the valve. This slows down the closing of contacts *a* and *d*.

4327	SOLENOID-OPERATED HYDRAULIC TIME RELAY MECHANISM	SmE Re



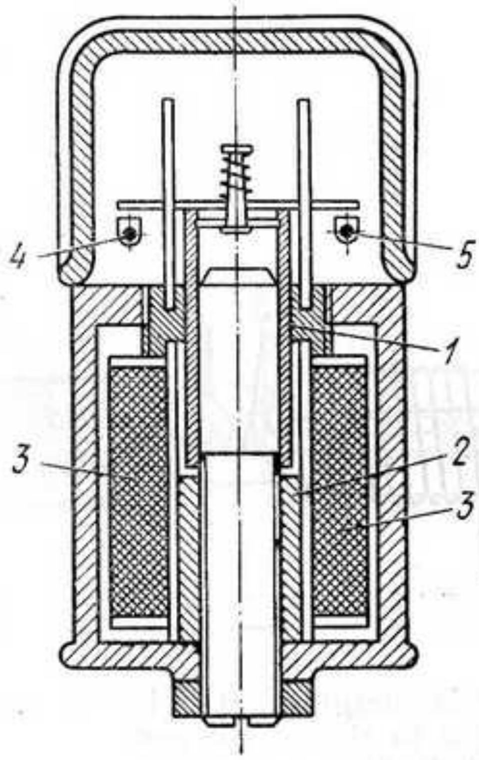
When solenoid *1* is energized, armature *2* is pulled upward, closing contacts *a*. The time lag is obtained by means of the liquid damper whose piston *3* is rigidly attached to armature *2*. The time lag is regulated by varying the diameter of hole *d* in piston *3*. By-pass *b* is provided to allow fluid to flow from above piston *3* to the space below it at the end of the piston stroke, so that contacts *a* are rapidly closed at the end of armature travel. This avoids burning of the contacts.

4328	SOLENOID-OPERATED HYDRAULIC TIME RELAY MECHANISM	SmE Re



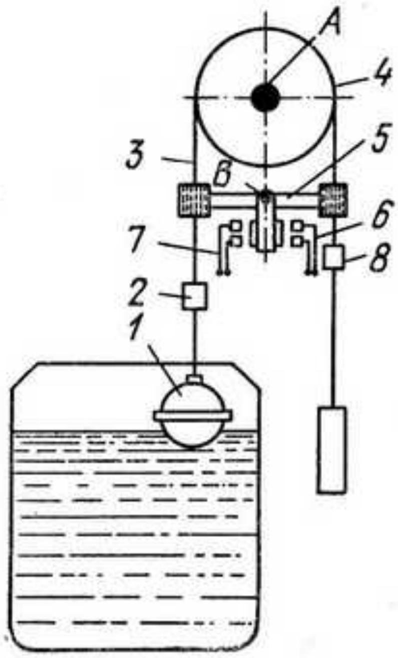
When solenoid *1* is energized, it pulls in armature *2*, which is linked by spring *3* to the rod of piston *4*. Piston *4* travels in cylinder *5*, which is filled with a viscous fluid. As the piston travels, fluid flows from one end of the cylinder to the other, passing through small holes in piston *4*, whose rod carries contact bridge *a*. The speed of the piston depends upon the viscosity of the fluid and the size of the holes. Thus, contacts *b* are closed with a certain time delay after switching on solenoid *1*. Spring *6* returns piston *4* to its initial position.

4329	ELECTRIC TIME RELAY MECHANISM	SmE Re



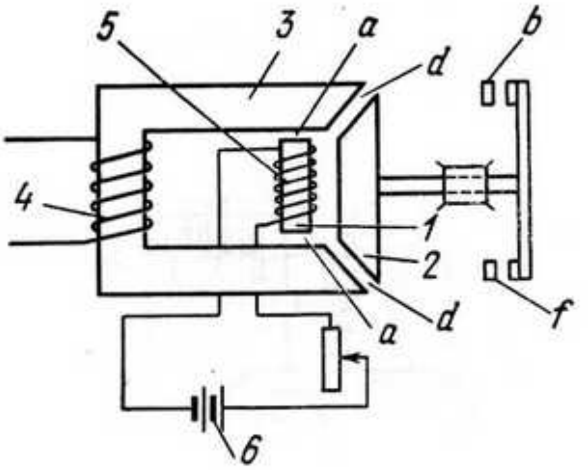
This relay is used in d-c circuits. It operates with a time lag whose length varies with the current of the electric motor. Loosely fitted in coil *3* is aluminium sleeve *1*, which rests on hollow steel cylinder *2*. The latter can be adjusted vertically by means of its internal thread. Aluminium sleeve *1* is the secondary shorted winding of the transformer whose primary winding is coil *3*, connected in series in the motor circuit. When coil *3* is energized, magnetic lines of force, produced by coil *3*, cut sleeve *1*. When the current varies in coil *3*, an emf is induced in sleeve *1*, which produces an electric current. This develops a force of interaction between the current flowing in sleeve *1* and the magnetic flux of coil *3*. The greater the current in the winding of coil *3*, the higher this force tosses sleeve *1* upward. At this, the sleeve opens contacts *4* and *5*. The higher the sleeve is displaced, the longer the time lag of the relay.

FLOAT-TYPE RELAY MECHANISM



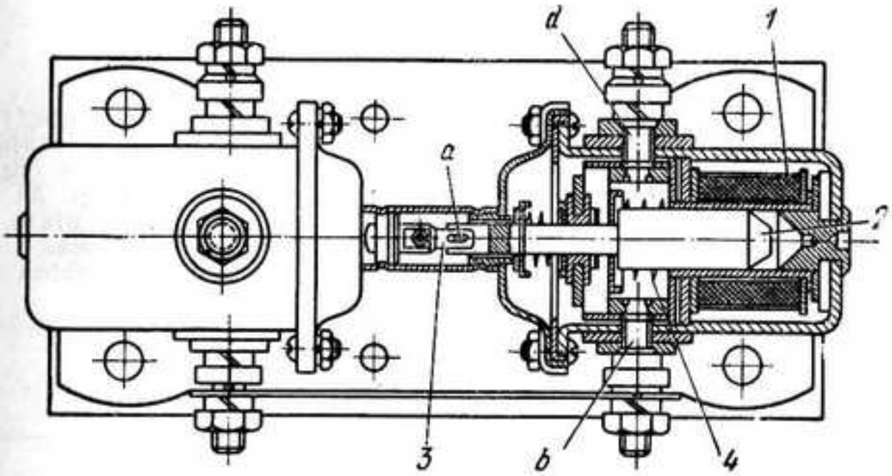
When the liquid level in the vessel increases above the preset value, float *1* rises and washer *2*, secured on flexible link *3*, turns rocker arm *5* clockwise about fixed axis *B* and closes left-hand contacts *7*. Flexible link *3* runs over pulley *4*, which rotates about fixed axis *A*. When the liquid level in the vessel drops below the preset value, washer *8* turns rocker arm *5* counter-clockwise and closes contacts *6*.

4331	SOLENOID-OPERATED RAPID-ACTION RELAY MECHANISM	SmE Re



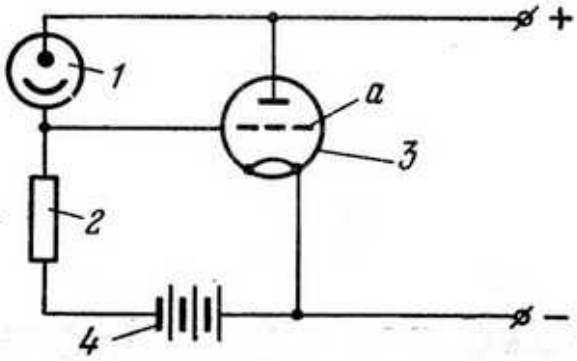
Solenoid *3* of the relay has two armatures, *1* and *2*. Armature *1* is fixed and air gap *a* between its ends and solenoid *3* is less than air gap *d* of armature *2* in its OFF position. Winding *4* is connected to the field circuit of the relay and winding *5* is energized by power source *6*. The magnetic fluxes Φ_1 and Φ_2, set up by the two coils, are added together. As long as the current in winding *4* is small, armature *1* is weakly magnetized and all of the resultant flux is through armature *1*. When the current in winding *4* increases, armature *1* becomes strongly magnetized, a part of flux Φ_1 is diverted into armature *2* and this armature is rapidly pulled to the left, closing contacts *b* and *f*. The speed with which the relay operates can be regulated by varying the current from power source *6* in winding *5* and the air gap *a*.

SOLENOID-OPERATED REVERSING AND INTERLOCKING RELAY MECHANISM



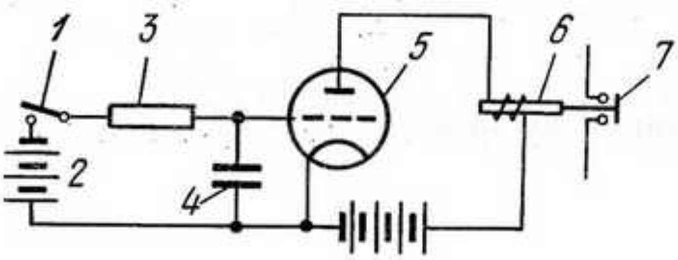
The mechanism consists of two switches, which are solenoids having their armatures linked together by interlocking tie-rod *3*. At one end, tie-rod *3* has elongated hole *a*, of a length equal to the stroke of armature *2*. When winding *1* of one of the solenoids is energized, armature *2* is pulled into the winding, closing contacts *b* and *d*, and, by means of interlocking tie-rod *3*, blocking the travel of the armature of the other solenoid. This closes the circuit of one of the electric motor windings. When coil *1* is de-energized, armature *2* is returned to its initial position by spring *4*, opening contacts *b* and *d*.

4333	LIGHT-SENSITIVE RELAY MECHANISM	SmE Re



When here is no illumination, there is no current in phototube 1 and resistor 2. A negative potential with respect to the cathode is applied to grid a of triode 3. Consequently, tube 3 does not conduct a current. When illuminated, phototube 1 becomes current conducting. At this, grid a of tube 3 is connected through phototube 1 to the plus plate voltage and the potential of the grid becomes positive. This produces a plate current in tube 3, which energizes the coil of a solenoid-operated relay (not shown), thereby tripping the relay.

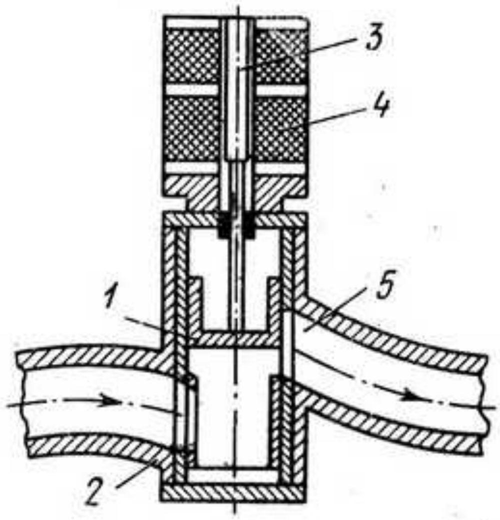
4334	ELECTRONIC TIME RELAY MECHANISM	SmE Re



When switch 1 is closed, capacitor 4 is charged by a d-c power source through series-connected resistor 3. The time required to charge capacitor 4 depends upon its capacity and the resistance of resistor 3. When the capacitor voltage reaches a definite negative value, tube 5 is blocked, the plate current drops to zero and relay 6, connected into the plate circuit of the tube, releases the armature of the relay, opening its contacts at bridge 7.

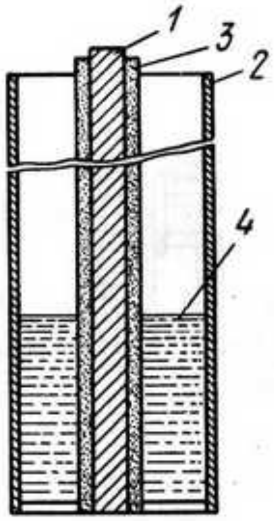
3. MECHANISMS OF MEASURING AND TESTING DEVICES (4335 through 4414)

4335	CONSTANT-PRESSURE-DROP FLOWMETER MECHANISM	SmE / M



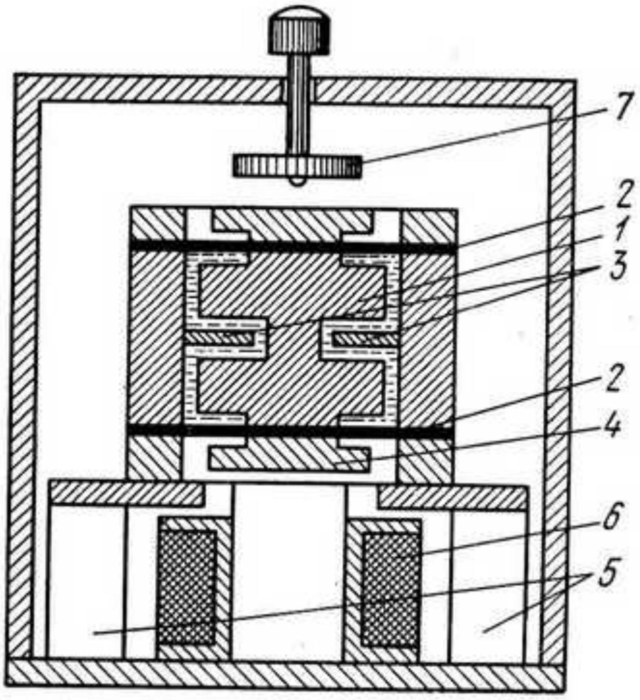
The principle of the constant-pressure-drop flowmeter is based on the comparison of the force exerted by the dynamic pressure of a fluid on a piston with the force exerted by its weight. As piston *1* travels up and down in accordance with the pressure in pipeline *2*, the clear opening of outlet *5* continually varies, as a result of which the fluid flow rate also changes. Piston *1* is attached to iron core *3*, which moves along inside coils *4*, changing their self-inductance. This is used to measure the rate of flow of the fluid.

4336	CAPACITIVE FUEL LEVEL GAUGE MECHANISM	SmE M



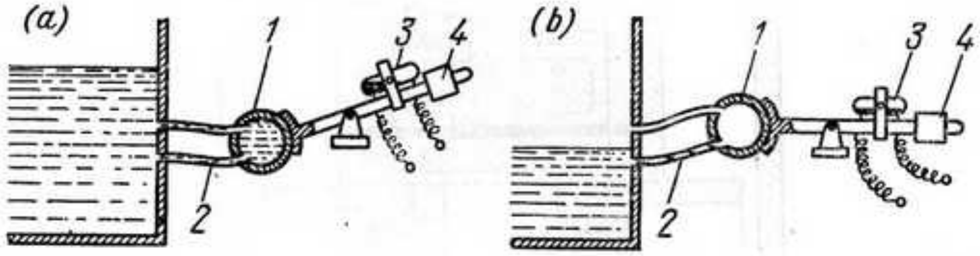
The sensor of the fuel level gauge is a cylindrical capacitor with inner electrode *1*, outer electrode *2* and insulating layer *3*. Between insulating layer *3* and outer electrode *2* is a layer of fluid (fuel) *4* whose level is to be controlled. When the level of fluid *4* varies in the capacitor, the capacitance also varies because the permittivity of the fluid and that of air differ. Variations in the capacitance of the capacitor are registered by the measuring instrument.

4337	INDUCTION ACCELEROMETER MECHANISM	SmE M



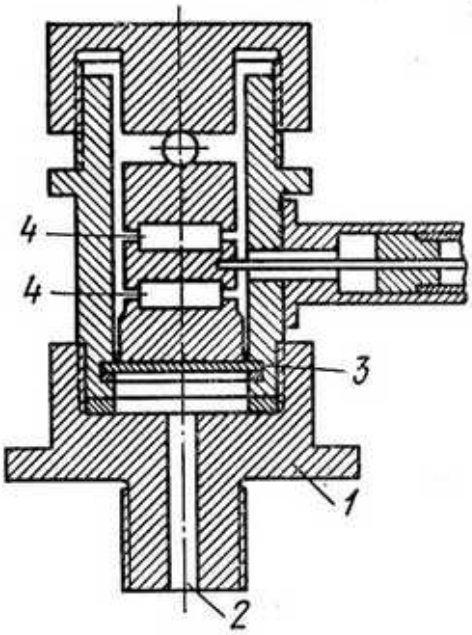
Sensitive element 1 is attached by flat springs 2 to the upright of the instrument. When the acceleration varies, sensitive element 1 is displaced. Armature 4, displaced together with sensitive element 1, changes the air gap and thereby varies the magnetic flux of permanent magnet 5. This induces an electromotive force in winding 6 of the coil of a magnitude proportional to the velocity of the sensitive element. The current produced is transmitted to an amplifier and then through a rectifier to the registering instrument. Damping plate 3 forces the oil to flow from the upper to the lower part of the mechanism, developing, thereby, a resisting force proportional to the first power of the displacement velocity and damping the natural oscillations of the system. The mechanism is calibrated by weight 7. Weight 7 is freed and drops by gravity. The instrument registers the acceleration of the weight at the instant it contacts sensitive element 1.

4338	MERCURY-SWITCH-TYPE FLUID LEVEL INDICATOR MECHANISM	SmE M



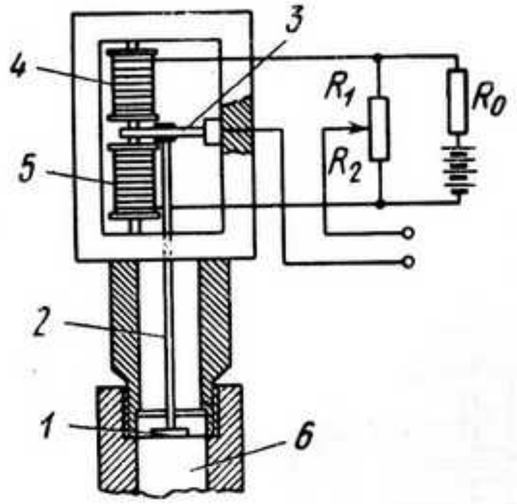
At the proper level of the fluid in the tank, hollow ball *1* connected to the tank by two flexible tubes *2*, is filled with the fluid and the indicator is in the position shown in Fig. *a*. Here, the contacts of mercury switch *3* are open. When the fluid level drops below the required value, ball *1* empties and is raised by weight *4* to the position shown in Fig. *b*. This closes the contacts of mercury switch *3*.

4339	PIEZOELECTRIC QUARTZ PRESSURE GAUGE MECHANISM	SmE M



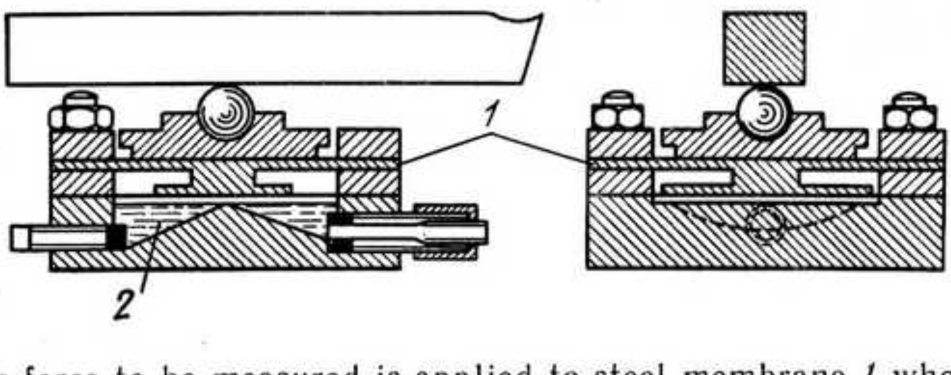
When pressure gauge *1* is connected to the vessel in which the pressure is to be measured, compressed air enters port *2* and bends membrane *3* upward. This compresses quartz wafers *4*, inducing electric charges on their surfaces. The magnitude of the charge indicates the pressure.

4340	OHMIC-RESISTANCE PRESSURE INDICATOR MECHANISM	SmE M



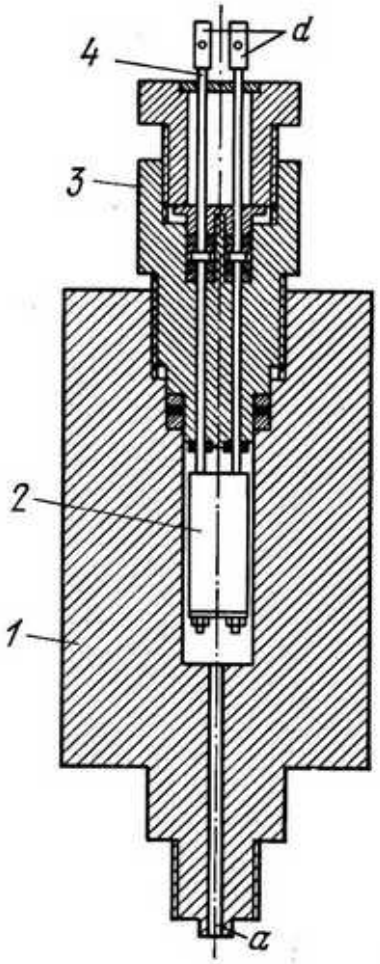
When the pressure varies in chamber *6*, diaphragm *1*, through rods *2* and *3*, changes the ohmic resistance of carbon piles *4* and *5*. If carbon piles *4* and *5* are connected into a bridge circuit so that the resistance of each carbon pile is a separate arm, and a d-c voltage is applied to the bridge input, we obtain an a-c voltage at the output that is proportional to the pressure in chamber *6*.

4341	LIQUID-RESISTANCE PRESSURE PICKUP MECHANISM	SmE M



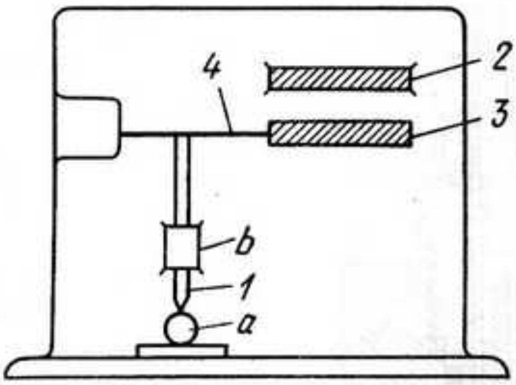
The force to be measured is applied to steel membrane *1* whose deflection reduces the cross section of liquid resistance *2*, filling the lower part of the pickup. Used for the liquid resistance is a solution of lead nitrate. Variations in the resistance of the pickup change the current which, in turn, characterizes a change in the force being measured.

4342	ZHOKHOVSKY PNEUMOMAGNETIC PRESSURE GAUGE MECHANISM	SmE M



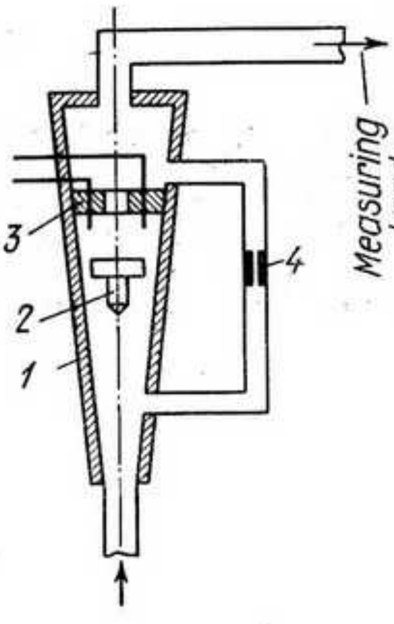
When body *1* of the gauge is connected to a space in which the pressure varies, compressed air is admitted into port *a*, affecting the resistance of the magnet arranged in a-c coil *2*. Coil *2* carries threaded member *3* screwed into the gauge body. Leads *4* have terminals *d* for connecting the coil into a circuit. The pressure to be measured is determined from the change in resistance.

4343	CAPACITY PICKUP MECHANISM FOR WORKPIECE INSPECTION	SmE M



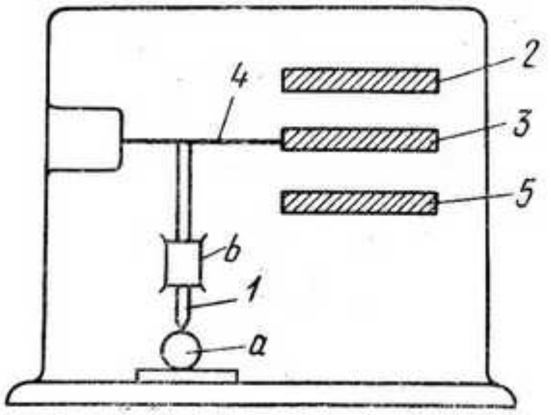
Measuring spindle *1* slides in guide *b* and bears against workpiece *a* being inspected. Spindle *1* moves capacitor plate *3* which is mounted on flat spring *4*. Movable plate *3* and fixed plate *2* are the plates of a capacitor whose capacitance depends upon the size of the workpiece. The change in capacitance indicates the size of the workpiece.

4344	GORODETSKY PNEUMATIC ELECTRIC-CONTACT FLOW-GAUGE MECHANISM	SmE M



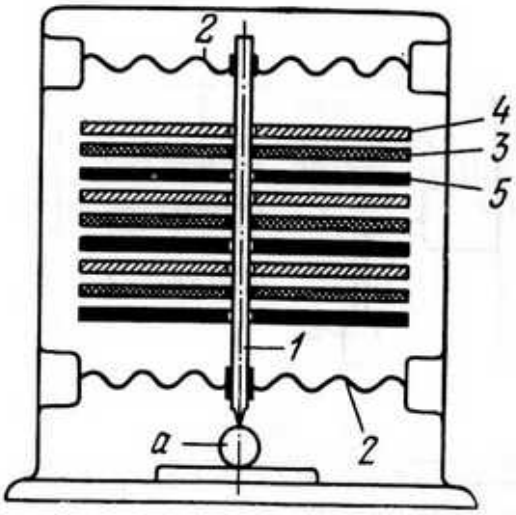
Compressed air is delivered through tapered column *1* containing float *2* and, in its upper part, two contacts *3*. The air flows further to the measuring head. At definite dimensions of the workpieces being inspected, float *2* closes contacts *3* of the signalling circuit. The air pressure is regulated by means of throttling device *4*.

4345	DIFFERENTIAL CAPACITY PICKUP MECHANISM FOR WORKPIECE INSPECTION	SmE M



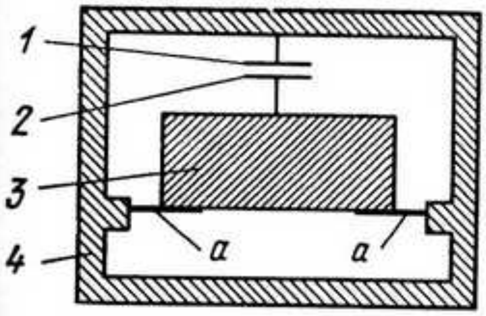
Measuring spindle *1* slides in guide *b* and bears against workpiece *a* being inspected. Spindle *1* moves capacitor plate *3* which is mounted on flat spring *4*. Movable plate *3* and fixed plates *2* and *5* are the plates of two capacitors, *3* and *5*, and *3* and *2*, whose capacitances depend upon the size of the workpiece. The differential effect in the variation of the capacitances increases the accuracy with which the size of the workpiece can be measured.

4346	MULTIPLE-PLATE DIFFERENTIAL CAPACITY PICKUP MECHANISM FOR WORKPIECE INSPECTION	SmE M



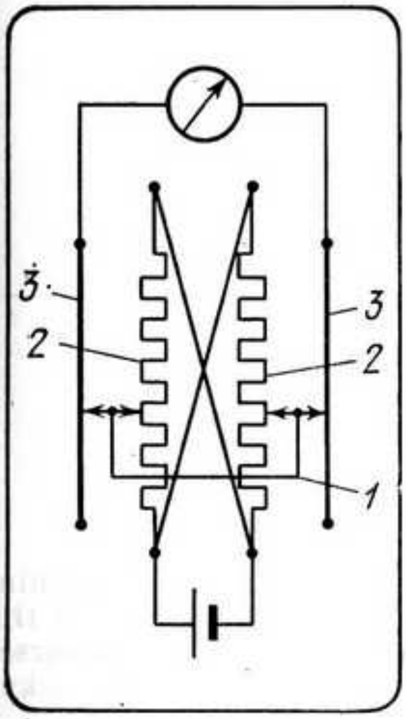
Measuring spindle *1* bears against workpiece *a* being inspected. It is supported by flexible membranes *2* and carries a system of movable capacitor plates *3*. Plates *3* are located between two systems of fixed plates *4* and *5*. This forms two capacitors with systems of plates *3* and *4*, and *3* and *5*, whose capacitances depend upon the size of the workpiece. The use of multiple-plate capacitors and the differential effect obtained by the plate arrangement increase the sensitivity of the pickup and reduce the effect of interference.

4347	CAPACITY SEISMOGRAPH MECHANISM	SmE M



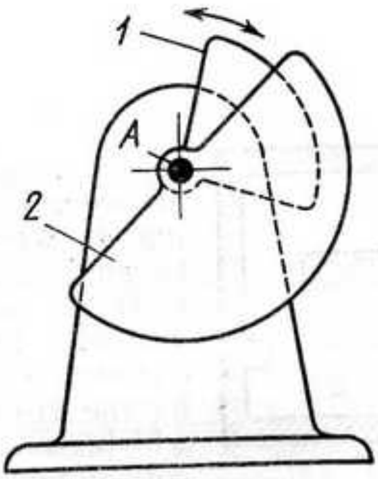
Heavy weight *3* lies on flexible plates *a* rigidly fixed in housing *4*. When the distance between fixed plate *1* and movable plate *2* of the capacitor is varied, its capacitance is changed. This distance is varied by the vibrations of housing *4* which can be measured and recorded by connecting capacitor *1-2* into an electrical measuring circuit.

4348	LINEAR DISPLACEMENT RESISTANCE TRANSDUCER MECHANISM	SmE M



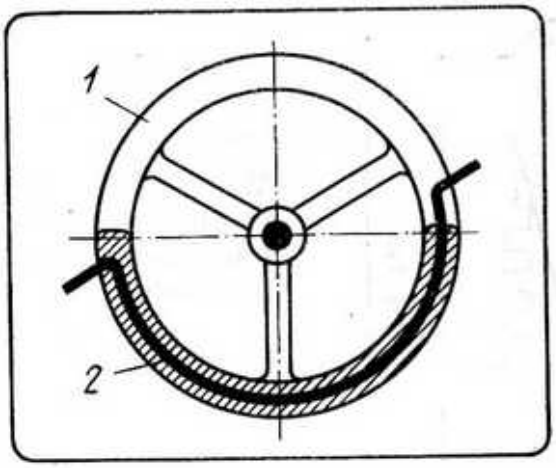
When slider *1* with its brushes is displaced along four parallel tensioned wires *2* and *3*, the resistance of the circuit is varied.

4349	ANGULAR DISPLACEMENT CAPACITY PICKUP MECHANISM	SmE M



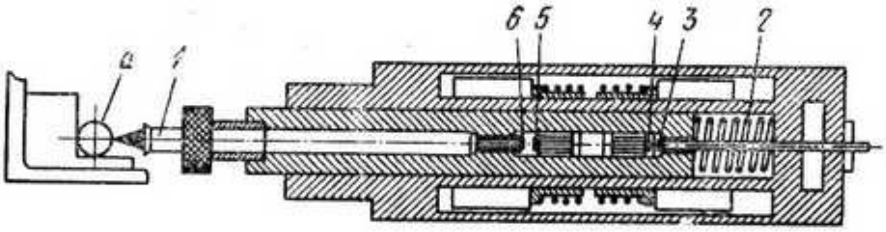
When plate *1* is turned about fixed axis *A*, the capacitance of the pickup, a variable capacitor consisting of plates *1* and *2*, changes. The dependence of the capacitance on the angle of rotation of plate *1* is a function that can be arbitrarily varied by suitably selecting the shapes of plates *1* and *2*. This pickup is applied in radio engineering devices to tune circuits.

4350	ANGULAR DISPLACEMENT CONTACTLESS MERCURY PICKUP MECHANISM	SmE M



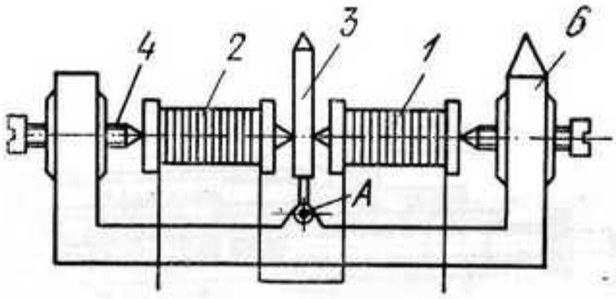
The pickup is designed as an annular glass tube *1* containing mercury. Sealed in the tube is platinum wire *2*. A part of this wire, depending upon the angular displacement, is immersed in mercury, i.e. short-circuited. The resistance of the pickup varies with a change in the angular position of tube *1*.

4351	ELECTRICAL-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	SmE M



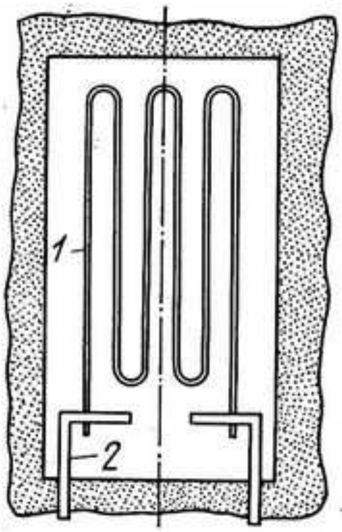
Measuring spindle *1*, bearing against workpiece *a* being inspected, is pushed to the left by spring *2* and, at the minimum limit of size of workpiece *a*, closes contacts *3* and *4*. When the workpiece is of larger size, spindle *1* moves to the right, opening contacts *3* and *4* and, at the maximum limit of size, contacts *5* and *6* are closed. The contacts close signalling circuits that enable over- or undersize workpieces to be rejected.

CARBON-PILE STRAIN GAUGE MECHANISM



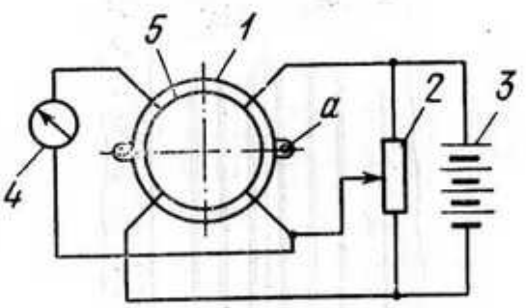
Two piles, *1* and *2*, of carbon plates are clamped in yoke *6* by means of screws *4*. Lever *3*, between piles *1* and *2*, turns about fixed axis *A*. This lever is attached to one of the strain gauge points. The other point is carried by yoke *6*. The instrument is mounted on the structure being tested so that elongation is transmitted to lever *3* by the point members. At this, lever *3* loads one pile and relieves the other. This reduces the resistance of the first pile and increases that of the second. Thus, the strain of the item being tested is measured by determining the change in resistance of the piles.

4353 **WIRE-TYPE STRAIN GAUGE MECHANISM** SmE M

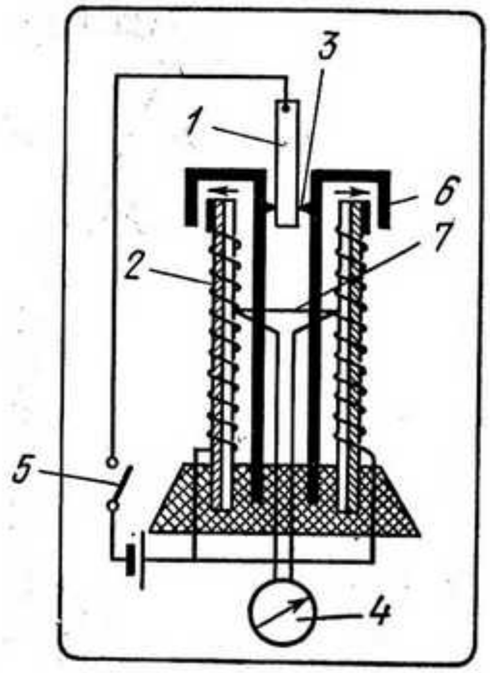


The wire-type strain gauge consists of wire *1* of a strain-sensitive material, several dozens of microns in diameter, glued to a paper backing. The strain gauge is glued to the surface of the item being tested. Soldered to the ends of wire *1* are thicker copper wire leads *2* by means of which the strain gauge is connected to the measuring circuit. This strain gauge enables surface deformation of the item to be measured, because the change in the resistance of wire *1* is proportional to the surface strain.

4354 **COMBINATION STRAIN GAUGE MECHANISM** SmE M

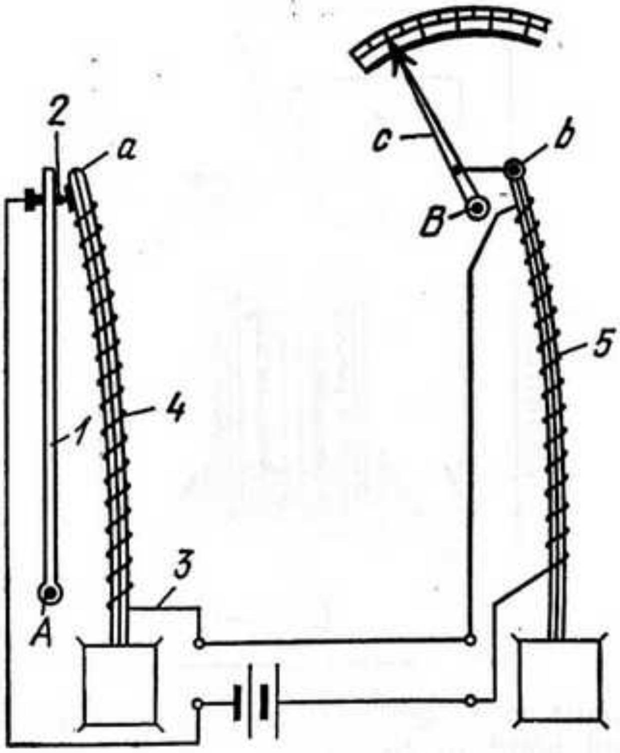


Sensitive elastic ring *1*, of an insulating material, has a uniform layer of carbon paste *5* applied to its inner surface. At four points (at 90° intervals), the paste is in contact with flexible leads. Obtained thus are four sections of resistance which constitute the four arms of a Wheatstone bridge. If ring *1* is deformed by applying forces to lugs *a*, which are attached to the item being tested, one pair of carbon sections is stretched and the other pair is compressed. The resistance of the first pair correspondingly increases and that of the second pair decreases, thereby changing the electrical state of the measuring bridge. The flexible leads connect the carbon sections to the power source *3* and to high-resistance potentiometer *2*, which serves to zero measuring instrument *4*. The readings of instrument *4* indicate the forces applied to the item being tested.



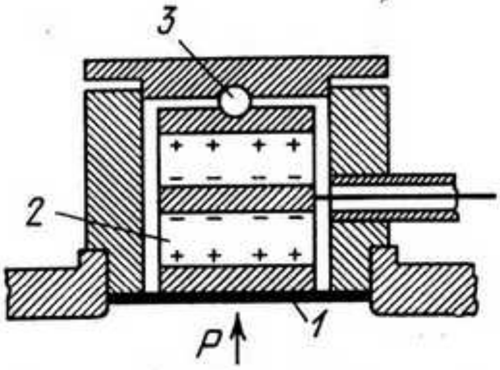
When the circuit is closed with switch *5*, bimetallic strips *2* are heated and bend in the directions shown by the arrows. Strips *2* continue to bend until they reach contact springs *6*. Further bending of the strips leads to retraction of contacts *3* from movable element *1*. This breaks the circuit. After this, bimetallic strips *2* oscillate about movable element *1*. At this, the temperature of each strip is maintained at a definite level. The temperatures of the two strips can be equalized by varying the distances between strips *2* and contact springs *6*. Now, when element *1* is displaced from its middle position, one strip is heated to a higher temperature and the temperature of the other strip is lowered. This establishes a temperature drop that can be measured with differential thermocouple *7* and galvanometer *4*. The reading depends directly on the displacement of element *1*.

4356	REMOTE-READING STRAIN GAUGE MECHANISM	SmE M



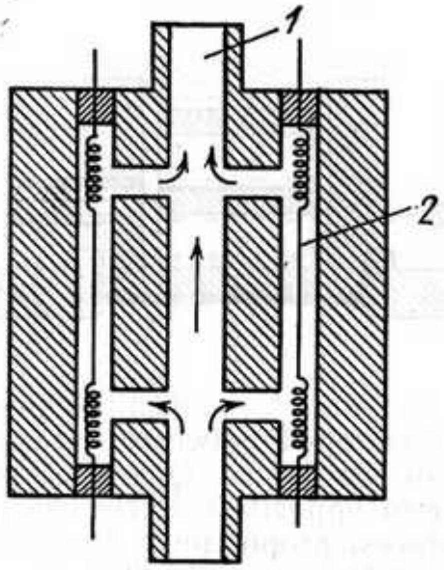
When lever *1*, turning about fixed axis *A*, is deflected to the right, contacts *2* are closed, energizing winding *3*. The current in winding *3* heats bimetallic strip *4* so that its free end *a* is deflected because the strip is bent due to the unequal thermal expansion of the metals making up the bimetallic strip. When lever *1* is deflected to the left, contacts *2* are opened, de-energizing winding *3*. At this, bimetallic strip *4* cools and its end *a* is deflected to the right. The motion of strip *4* is repeated at a distance by identical strip *5*, which is heated by a winding connected in series to winding *3*. End *b* of strip *5* is connected by a link and turning pairs to hand *c* which turns about fixed axis *B*. On a scale, hand *c* indicates the deflection of ends *a* and *b* of bimetallic strips *4* and *5*. This deflection is proportional to the deflection of lever *1*, which is linked to the strain gauge.

4357	PIEZOELECTRIC QUARTZ PICKUP MECHANISM FOR A PRESSURE GAUGE	SmE M



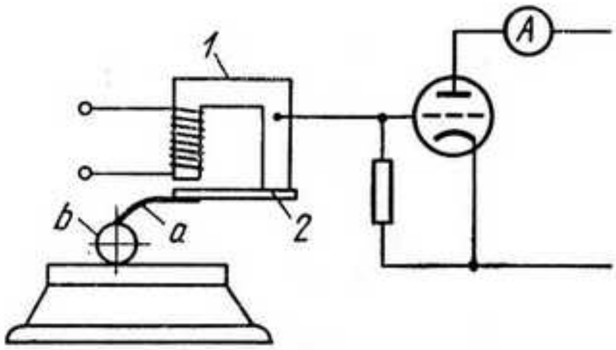
Pressure P is transmitted through thin metallic membrane *1* to quartz wafers *2* clamped between plates. Steel ball *3* serves for self-alignment of the device. Quartz crystals are capable of developing equal and opposite electric charges on certain elements of their surfaces, proportional to the elastic mechanical deformation to which they are subjected. The charges disappear when the force load is removed. A single lead is connected to the middle plate. The second conductor is the housing. The leads are connected to an electrical measuring instrument.

4358	GAS ANALYZER PICKUP MECHANISM	SmE M



The gas being investigated flows slowly through channel *1* of a heavy metal cylinder in which thin platinum filament *2* is stretched and heated to 100 °C. The coefficient of heat transfer depends upon the thermal conductivity of the gas.

4359	ELECTROMAGNETIC MEASURING MECHANISM FOR WORKPIECE INSPECTION	SmE M



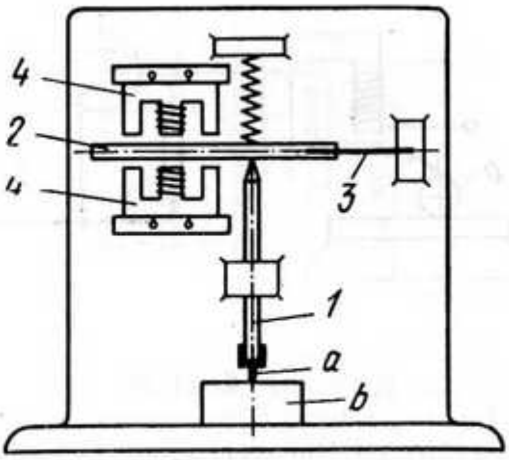
When the coil of electromagnet *1* is energized by alternating current, armature *2*, carrying flexible tip *a*, vibrates. When workpiece *b*, to be inspected, is advanced to measuring tip *a* of armature *2*, the ratio of the period of the closed state of the contacts they constitute to the period of the open state depends upon the size of workpiece *b*. The armature tip is connected to the grid of an electron tube, and a negative potential is applied to the workpiece being inspected. The average value of the plate current in the electron tube can serve as a measure of the clearance between the measuring tip and the workpiece. An ammeter, connected into the plate circuit of the tube, can be graduated in units of size of the workpiece.

4360

INDUCTANCE PICKUP MECHANISM FOR WORKPIECE INSPECTION

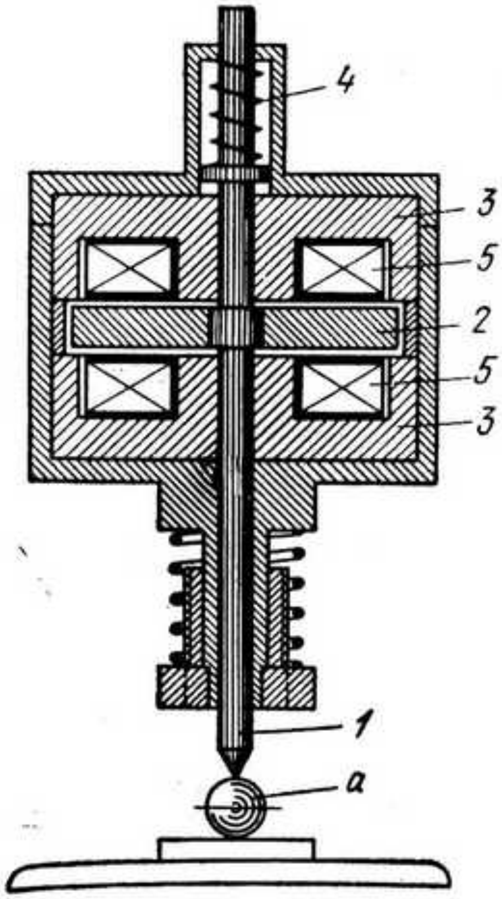
SmE

M



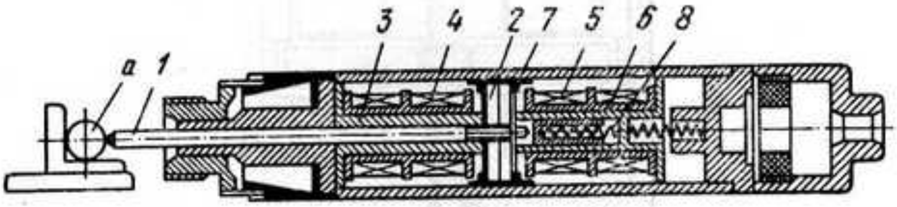
By means of spindle *1*, measuring tip *a*, which contacts workpiece *b* being inspected, displaces armature *2* mounted on flexible flat spring *3*. The clearances between armature *2* and the coils of electromagnets *4* vary with the size of workpiece *b*. This varies the inductance of the coils. The inductance is used as a measure of the workpiece size.

4361	INDUCTANCE PICKUP MECHANISM FOR WORKPIECE INSPECTION	SmE M



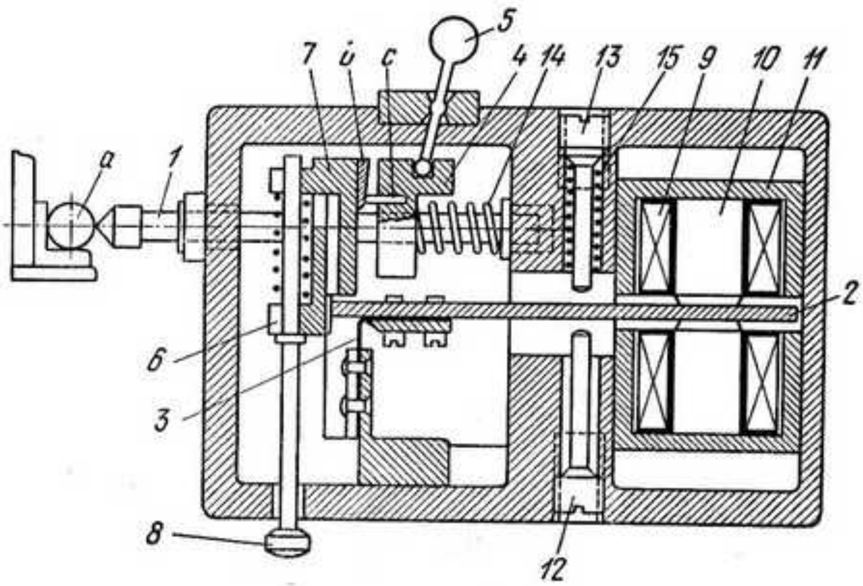
Measuring spindle *1*, contacting workpiece *a* being inspected, slides in a hole of the pickup housing. Armature *2* is press-fitted on spindle *1*. Heavy cylindrical magnetic circuit components *3*, with inserted coils *5*, are tightly fitted into the pickup housing. The clearances between armature *2* and magnetic circuit components *3* vary with the size of workpiece *a*. This varies the inductance of the coils. The inductance is used as a measure of workpiece size. Spring *4* provides the required measuring force.

4362	INDUCTANCE PICKUP MECHANISM FOR WORKPIECE INSPECTION	SmE M



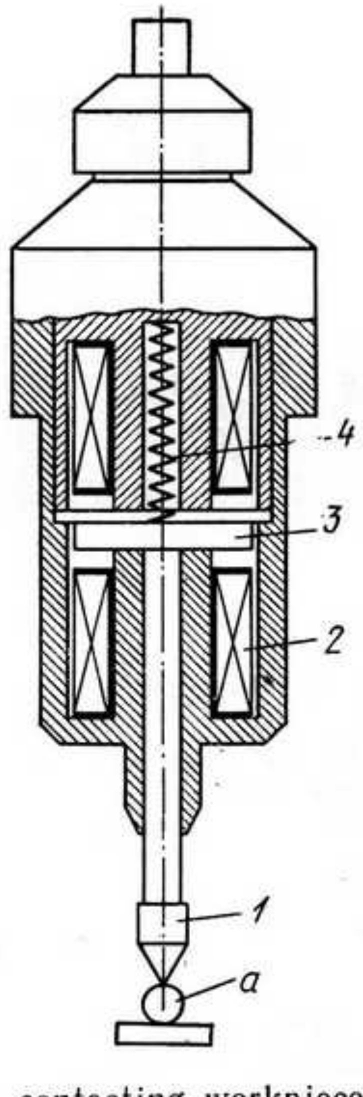
Measuring spindle *1*, contacting workpiece *a* being inspected, slides in the hole of core *3* in coil *4*. Screwed on spindle *1* is armature *2*, consisting of two round disks. The pickup has two coils, *4* and *5*, whose magnetic circuit is formed by cores *3* and *6*, the pickup housing and plates 7. Spring *8* provides the required measuring force. The clearances between armature *2* and the magnetic circuits vary with the size of workpiece *a*. This varies the inductance of the coils. The inductance is used as a measure of the workpiece size.

4363	INDUCTANCE PICKUP MECHANISM FOR WORKPIECE INSPECTION	SmE M



Measuring spindle *1* contacts workpiece *a* being inspected. Lug *4*, mounted rigidly on spindle *1*, carries stop pin *c* and prevents rotation of the spindle. Lug *4* is connected by a spherical pair to lever *5*, used for manually advancing and retracting spindle *1*. Armature *2* is secured to the housing by flat spring *3*, which is bent to a right angle. At its left end, armature *2* has bracket *6* along which slide *7*, carrying wedge *b*, travels. Slide *7* is adjusted by screw *8* and is used to set the relative position between spindle *1* and armature *2*. Rectangular coils *9* are fitted on core *10*. The magnetic circuit consists of core *10* and yoke *11*. Screws *12* and *13* limit the displacement of armature *2*. The measuring force is determined by the combined action of springs *3*, *14* and *15*. The clearances between armature *2* and the magnetic circuit vary with the size of workpiece *a*. This varies the inductance of the coils. The inductance is used as a measure of workpiece size.

4364	INDUCTANCE PICKUP MECHANISM FOR WORKPIECE INSPECTION	SmE M



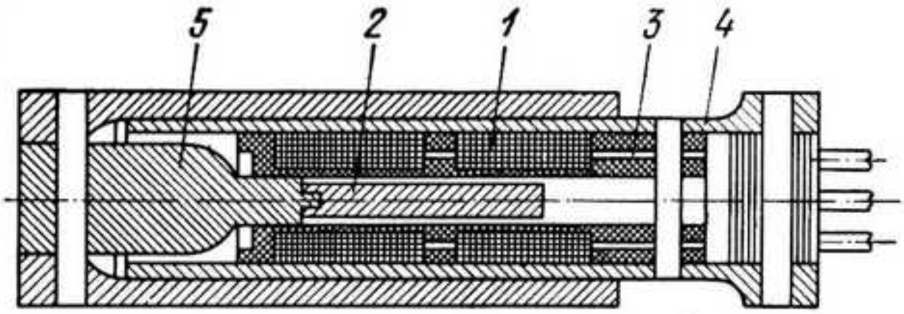
Measuring spindle *1*, contacting workpiece *a* being inspected, slides in a hole of the pickup housing. Overcoming the resistance of spring *4*, spindle *1* moves armature *3* an amount depending upon the size of workpiece *a*. This changes the clearances between armature *3* and two electromagnets *2*, thereby changing their impedance. The impedance of the coils of electromagnets *2* is used as a measure of the workpiece size.

4365

INDUCTANCE-TYPE MICROMETRIC STRAIN GAUGE MECHANISM

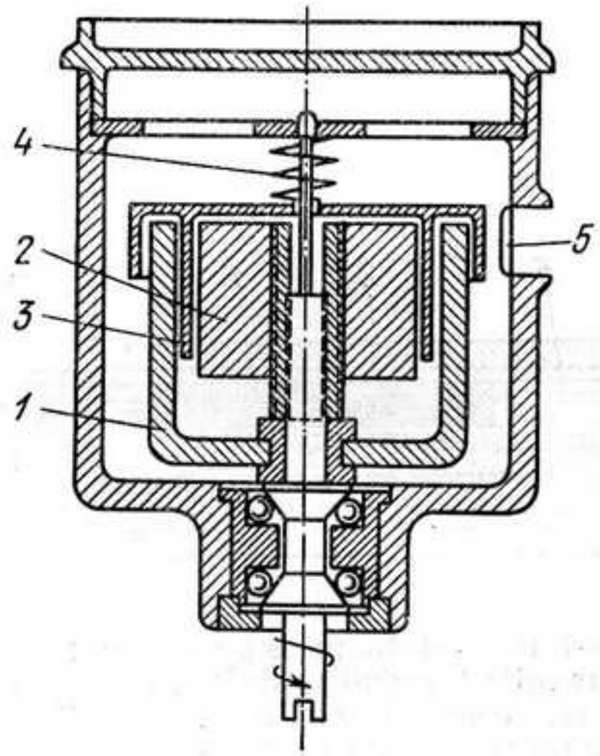
SmE

M

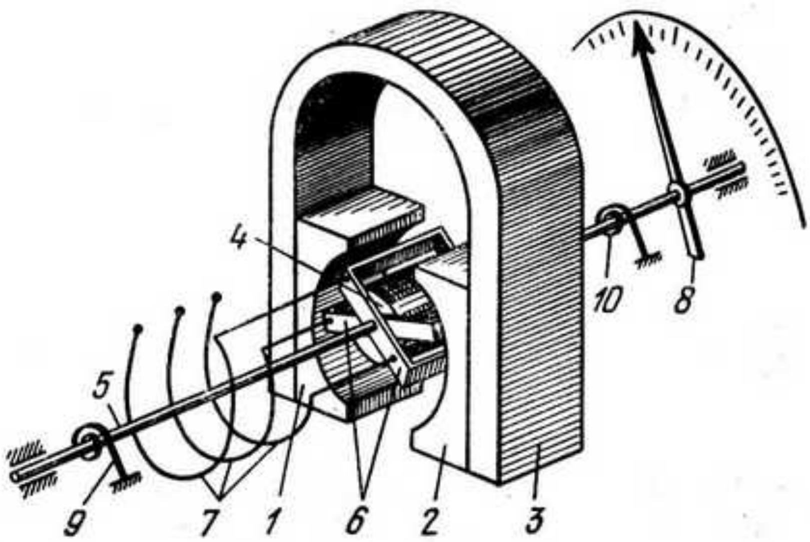


The instrument is used to measure a small displacement of tube *4*, with its coils *1* wound on shell *3*, with respect to member *5* with the core. Armature *2* is displaced within two coils *1*, thereby changing their inductance. The inductance of coils *1* is used as a measure of the displacement of, for example, a strain gauge.

4366	MAGNETIC TACHOMETER MECHANISM	SmE M

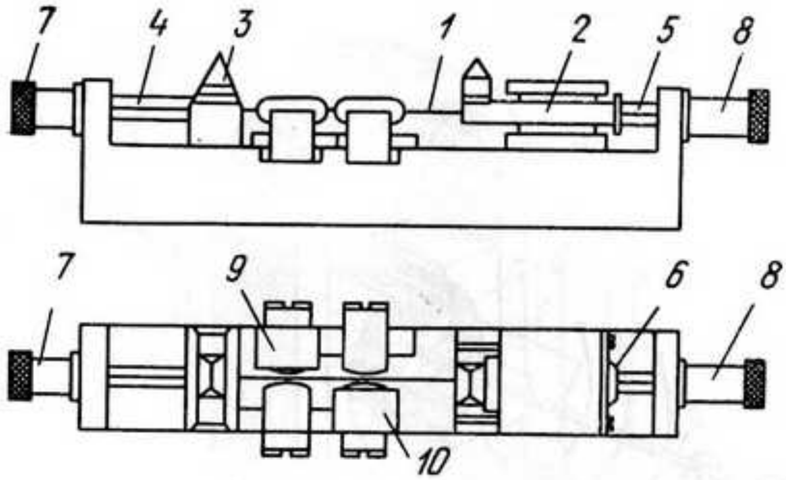


The magnetic tachometer consists of rotary bell-shaped permanent magnet *1* and core *2*, between which there is a narrow gap. Arranged in this gap is hollow aluminium cylinder *3*, held against rotation by coil spring *4*. The rotating magnetic field induces currents in cylinder *3* which tend to rotate the cylinder with a force whose torque is proportional to the speed of rotation of magnet *1*. A scale with uniform divisions is engraved on the outside circumference of cylinder *3*. It indicates the speed (rpm) of magnet *1*, and of the shaft whose speed is to be measured, in opening *5*.

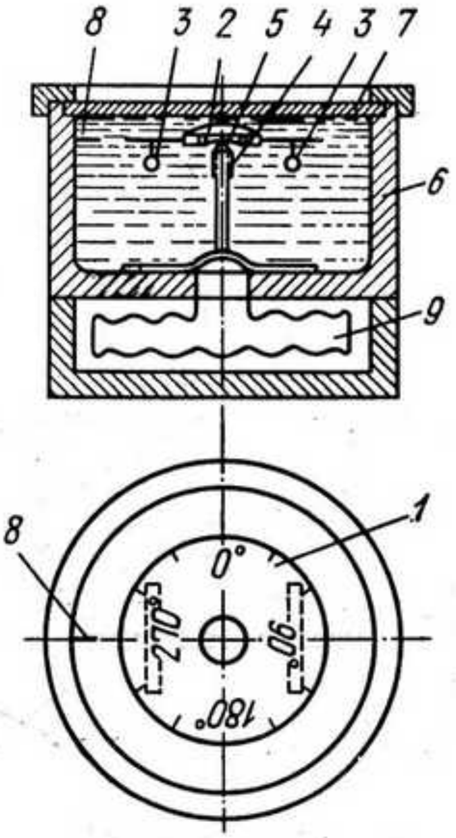


Arranged between pole shoes *1* and *2* of steel magnet *3* is stationary iron cylinder *4* which imparts a radial direction to the lines of force of the magnet. Secured to shaft *5* are rotary frames *6*, which are coils arranged at a certain angle with respect to each other. When there is a current in frames *6*, their own magnetic flux interacts with that of magnet *3*, developing a force proportional to the current. The current is supplied by means of three hairsprings 7, which have a very small torque in comparison to the torque of frames *6*. The angle of deflection of hand *8*, mounted rigidly on shaft *5*, is proportional to the current. Spiral springs *9* and *10* develop a torque preventing rotation of frames *6* and turn the hand to zero when there is no current in the frames.

4368	VIBRATING WIRE STRAIN GAUGE MECHANISM	SmE M

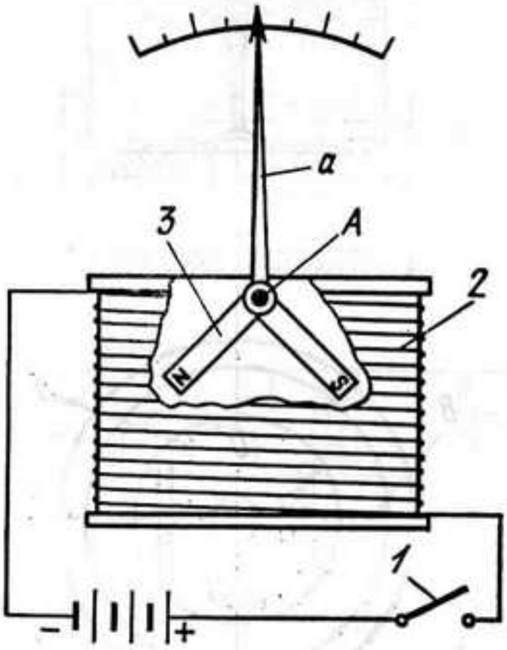


The operation of a vibrating wire strain gauge is based on the principle that the natural frequency of vibration of a stretched wire depends upon the force stretching the wire. One end of wire *1* is secured to movable prism *2*; the other end passes through a hole in stationary prism *3* and is secured to tensioning screw *4*. The movable prism is linked to tensioning screw *5* at the other end of the gauge by means of spring *6*. The tension of the wire can be regulated by turning nut *7* or nut *8*. Wire *1* passes between two pairs of pole shoes of two polarized electromagnets *9* and *10*. The purpose of the electromagnets is to set wire *1* into mechanical vibration and to convert this vibration into electrical oscillations, which are measured in some suitable way. In measuring elongation, the strain gauge is mounted on the workpiece with the points of prisms *2* and *3* engaging indentations in the workpiece.



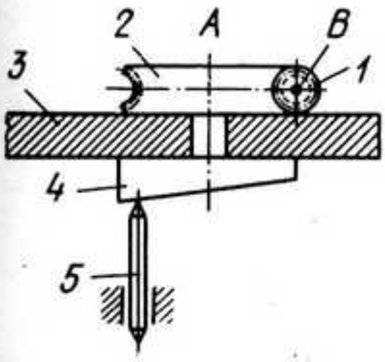
The main part of a compass is its magnetic system (card). The compass card consists of thin brass or aluminium disk *1* graduated by degree divisions up to 360°. This disk carries empty float 2. Secured to disk *1* symmetrically under the float is a pair of magnets *3*, whose axes are parallel to the 0-180° line on disk *1*. Like poles of magnets *3* point in the same direction. With its pin *5* the compass card rests on a cup of hard stone, fitted into column *4* of the compass and called the compass cap. Column *4* serves as the support for the compass card and is arranged inside compass bowl *6*, which is an aluminium vessel closed by watertight glass cover 7. Under the glass is course line *8* in the form of a thin wire, arranged above disk *1* and serving as an index in reading off the compass heading. Compass bowl *6* is filled with a liquid for damping oscillations of the card. Bowl *6* is connected to membrane chamber *9*. Chamber *9* serves to compensate for the change in volume of the liquid upon changes in temperature.

4370	MILLIAMMETER MECHANISM	SmE M



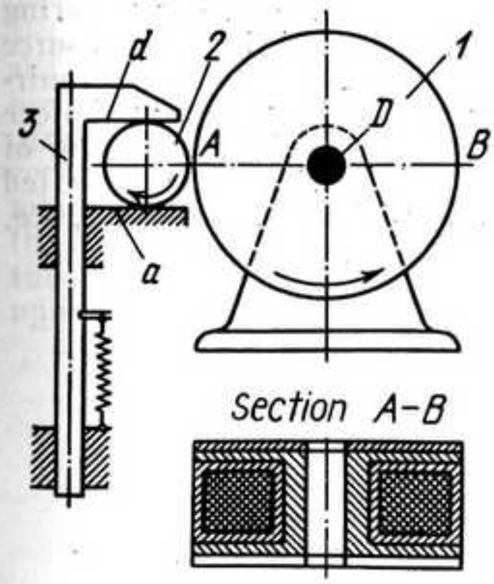
When switch *1* is closed, electromagnet coil *2* is energized and a magnetic field is set up around it. The direction of the lines of force in the field inside coil *2* is opposite to that of the lines of force in the field of permanent magnet *3*. As a result of the algebraic addition of the lines of force of the two fields, magnet *3* is turned clockwise about fixed axis *A*. Hand *a* of the instrument, rigidly mounted on magnet *3*, also turns. When the direction of the current in coil *2* is reversed, the direction of the lines of force in the field inside coil *2* is also reversed, but the direction of the lines of force in the field of permanent magnet *3* remains as before. In this case, magnet *3* and hand *a* turn counterclockwise. The deviation of hand *a* from the zero position is proportional to the force of interaction of the fields of coil *2* and magnet *3*, i.e. to the current in coil *2*.

4371	WORM GEARING MECHANISM FOR SETTING INDUCTANCE PICKUPS	SmE M



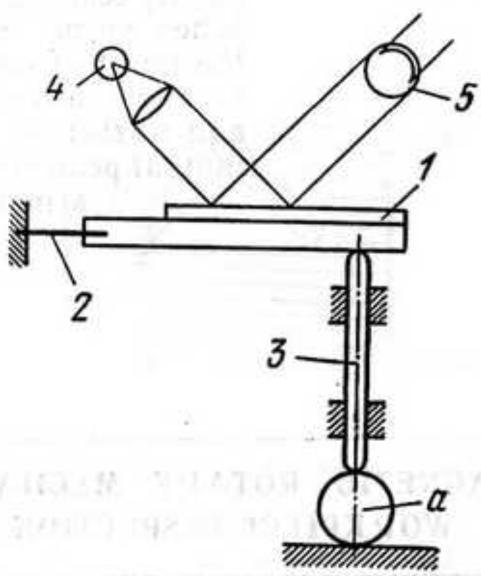
Worm wheel 2, rotating about fixed axis A, is rigidly mounted on armature 3 and is driven by worm 1, which rotates about fixed axis B. Measuring spindle 5 bears against the lower slanted face of washer 4, which is rigidly secured to worm wheel 2. When worm wheel 2 is turned, the point of contact is changed between measuring spindle 5 and washer 4. This adjusts the mutual position of spindle 5 and armature 3.

4372	ELECTROMAGNETIC ROTARY MECHANISM FOR WORKPIECE INSPECTION	SmE M



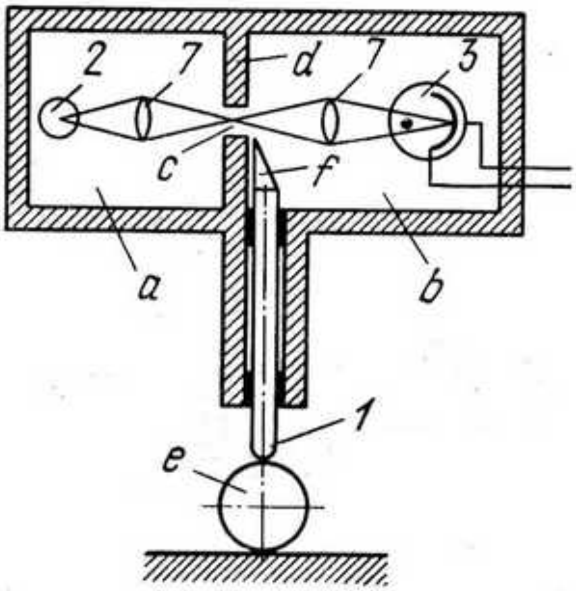
When electromagnet 1 is rotated about fixed axis D, it induces eddy currents in metal workpiece 2 being inspected. Interaction of these currents with the field of electromagnet 1 develops a torque which turns workpiece 2 in the direction opposite to the rotation of electromagnet 1. Workpiece 2 bears against fixed jaw a and is held against this jaw by movable jaw d, which is rigidly secured to measuring spindle 3 of the measuring device. This device checks the roundness of workpiece 2.

4373	PHOTOELECTRIC SENSOR MECHANISM FOR WORKPIECE INSPECTION	SmE M



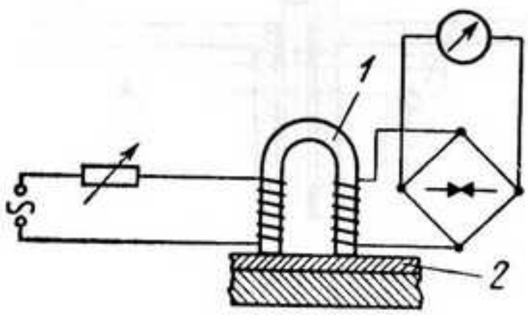
Mirror *1*, mounted in the sensor housing by means of flat spring *2*, bears against measuring spindle *3*. A beam of light from source *4* is reflected by mirror *1* to phototube *5*. The position of mirror *1*, turned by spindle *3*, depends upon the size of workpiece *a* that the spindle contacts. The intensity of illumination of phototube *5* and, consequently, the electric current excited by the phototube depends upon the position of mirror *1*, i.e. on the size of workpiece *a*.

4374	PHOTOELECTRIC SENSOR MECHANISM FOR WORKPIECE INSPECTION	SmE M



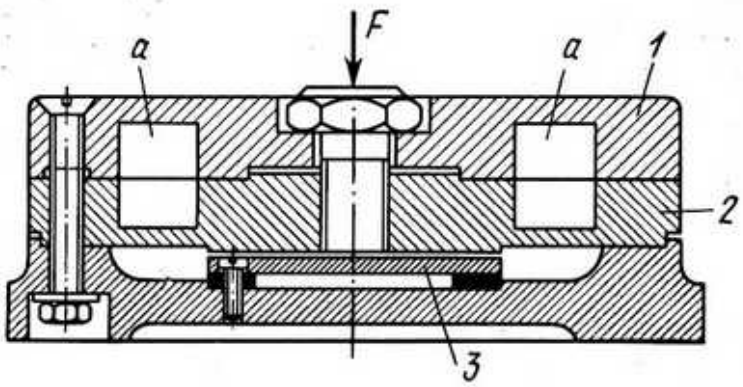
Two chambers, *a* and *b*, are separated by partition *d* which has slit *c*. Light source *2* is arranged in chamber *a* and, through slit *c*, it illuminates phototube *3* in chamber *b*. Lenses 7 are provided between light source *2* and phototube *3* to focus and direct the light beam. The lower tip of measuring spindle *1* contacts workpiece *e* being inspected. The amount that shutter *f*, mounted at the top end of spindle *1*, covers slit *c* depends upon the size of workpiece *e*. The intensity of illumination of phototube *3* and, consequently, the photoelectric current, depend upon the position of shutter *f*, i.e. on the size of workpiece *e*.

4375	ELECTRIC MUTUAL INDUCTANCE PICKUP MECHANISM	SmE M



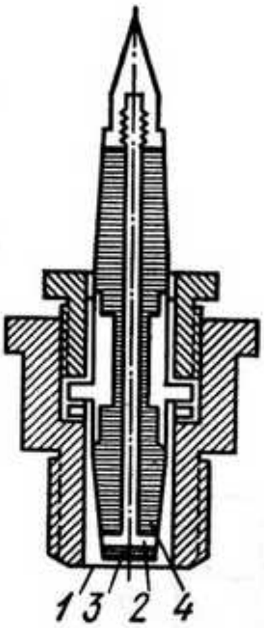
The pickup is used to measure the thickness of protective layer *2* on ferromagnetic materials. Magnetic circuit *1* with two windings is placed directly on the item to be measured. The coefficient of mutual inductance of the windings varies with the thickness of protective layer *2*, which is equal in the given magnetic system to the air gap.

4376	CAPACITY STRAIN GAUGE MECHANISM	SmE M



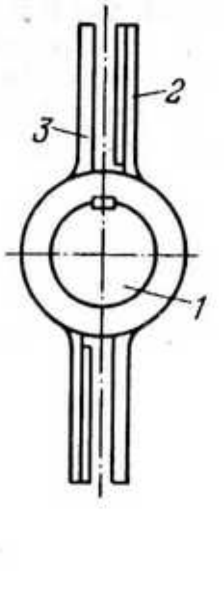
Two steel disks, *1* and *2*, with annular slots *a*, joined together at the centre and edges by bolts, constitute a membrane of the pickup and, at the same time, one of the plates of a capacitor. The second plate is steel disk *3*, which is carefully insulated from the first two disks. Force *F* bends the membrane consisting of disks *1* and *2* downward, reducing the gap between the capacitor plates and increasing the capacitance of the capacitor. This change in capacitance is measured by special instruments.

4377	CAPACITY PRESSURE INDICATOR MECHANISM	SmE M



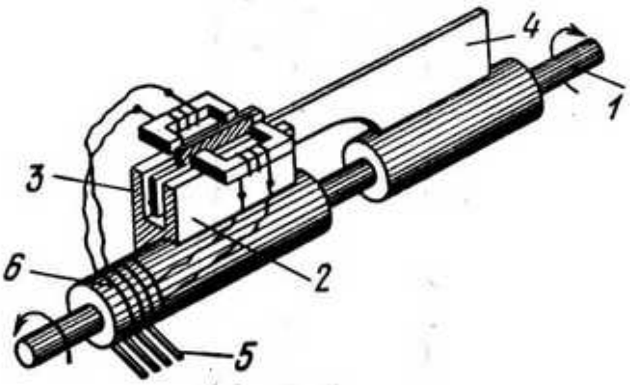
Stationary electrode *2* is insulated from the housing by mica and ceramic insulation *4*. The dielectric of the capacitor consists of layer *3* of mica and a layer of air. A change in the pressure applied to diaphragm *1*, the second electrode, changes the distance between diaphragm *1* and stationary electrode *2*. This changes the capacitance of the capacitor.

4378	CAPACITY PICKUP MECHANISM FOR TORQUE MEASUREMENT	SmE M



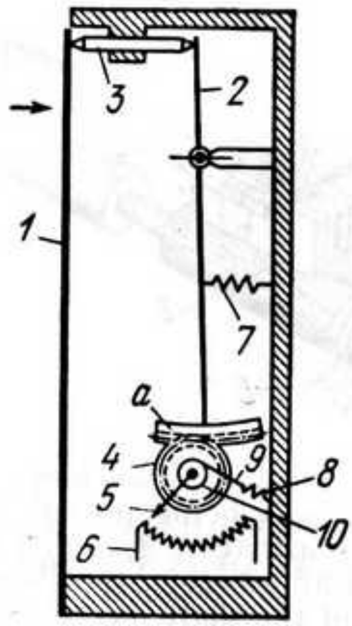
Mounted on shaft *1* subject to torsion are two bushings which carry capacitor plates *2* and *3*, arranged parallel to the axis of the shaft. One of the plates is insulated from the shaft and is positioned with a certain air gap parallel to the other plate. When the shaft is twisted in torsion, the distance between plates *2* and *3* is changed. This changes the capacitance of the capacitor they form. The change in capacitance is recorded by a suitable measuring instrument.

4379	INDUCTANCE PICKUP MECHANISM FOR MEASURING THE ANGLE OF TWIST OF SHAFTS	SmE M



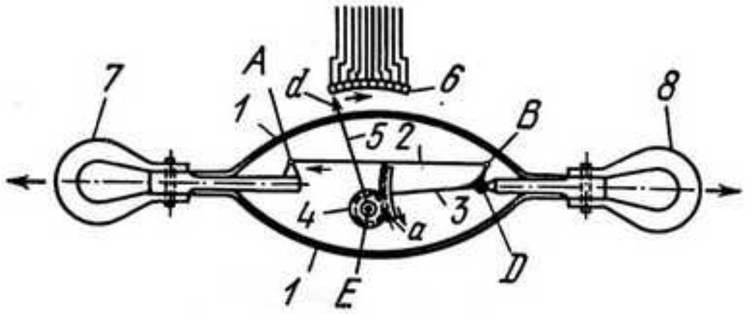
Two cores, *2* and *3*, of an inductance pickup are rigidly secured to one section of the shaft being investigated. Secured to the other section is pickup armature *4*, which is arranged at equal distances from cores *2* and *3* when the shaft is not loaded with a torsion load. Twist of the shaft increases the air gap between armature *4* and one of the cores and, at the same time, reduces the gap between armature *4* and the other core. Electric current is supplied to the coils through brushes *5* and slip rings *6*. Changes in the air gaps between armature *4* and cores *2* and *3* increase the reactance of one coil and reduce that of the other. The changes in reactance of the coils is used to determine the relative displacement of armature *4* with respect to cores *2* and *3*. This displacement is used to find the angle of twist of the section of the shaft.

4380	ELECTRIC DYNAMOMETER MECHANISM	SmE M



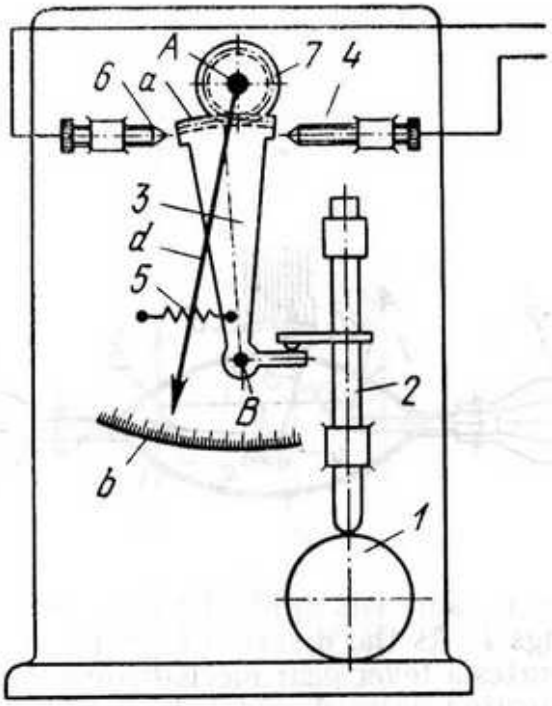
When the force acting on flat spring *1* is increased, lever *2* is turned clockwise by pin *3*. Segment gear *a* at the bottom end of lever *2* meshes with pinion *4* on whose shaft slider *5* of rheostat *6* is rigidly mounted. Lever *2* is held against pin *3* by spring *7*. Spring *8* and strap *9*, running over roller *10*, eliminate backlash between segment gear *a* and pinion *4*. Roller *10* is rigidly mounted on the shaft of pinion *4*. The resistance of rheostat *6* depends upon the deflection of spring *1* and, consequently, on the force applied to this spring.

4381	ELECTRIC-CONTACT TENSION DYNAMOMETER MECHANISM	SmE M



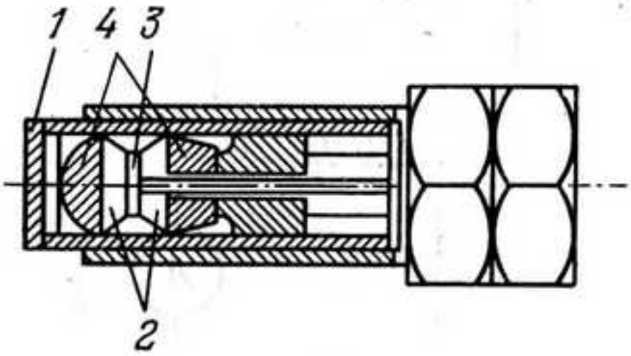
The force to be measured is applied to lugs *7* and *8*, linked together by springs *1*. As the distance is increased between lugs *7* and *8*, this operates a lever-gear mechanism consisting of link *2*, connected by turning pairs *A* and *B* to lug *7* and bell-crank lever *3*. Lever *3* turns about fixed axis *D* and has segment gear *a* which meshes with pinion *4*, rotating about fixed axis *E*. Rigidly attached to pinion *4* is lever *5* whose brush *d*, at the end of the lever, slides along a set of commutator segments *6*, insulated from one another. Segments *6* are connected to an electrical measuring instrument which indicates the force being measured.

4382	ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	SmE M



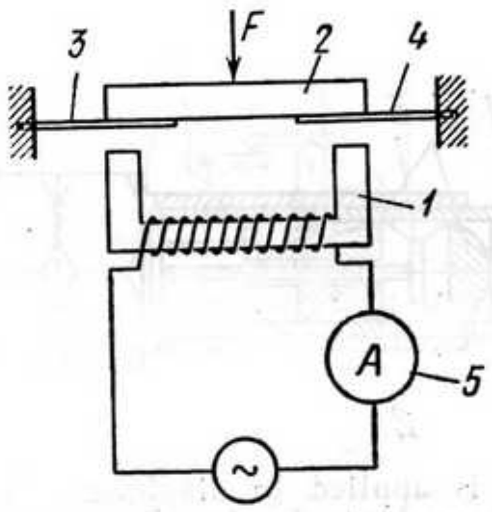
Pinion 7, on which hand d is rigidly mounted, rotates about fixed axis A and meshes with segment gear a, turning about fixed axis B of lever 3. The size of workpiece 1 is indicated on scale b by hand d. The position of hand d depends upon the positions of lever 3 and measuring spindle 2, which contacts workpiece 1 and engages lever 3 with a lug. At the minimum limit of size of workpiece 1, spindle 2 moves downward, turning lever 3 clockwise and closing a circuit by contacting screw 4. At the maximum limit of size, spindle 2 moves upward so that spring 5 turns lever 3 counterclockwise, closing a second circuit by contacting screw 6. The two circuits closed at screws 4 and 6 are signalling circuits that enable over- and undersize workpieces to be rejected.

4383	PIEZOELECTRIC QUARTZ PICKUP MECHANISM FOR A PRESSURE GAUGE	SmE M



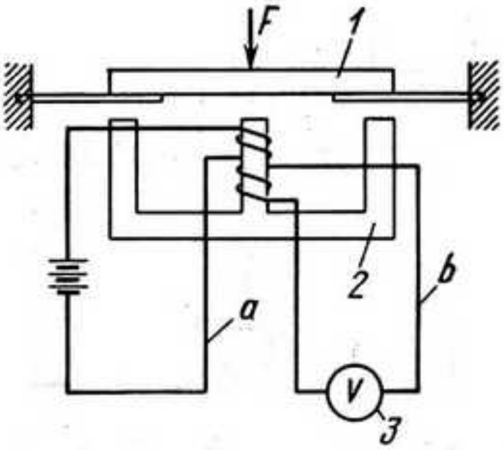
When pressure is applied to diaphragm *1*, electric charges (piezoelectric charges) are developed on the surfaces of quartz wafers *2*, which contact electrode *3* and plates *4*. The amount of the charges is proportional to the pressure applied to diaphragm *1*. Metal plates *4* serve to transmit pressure from diaphragm *1* to crystal wafers *2*. Electrode *3* serves to conduct the charges to the measuring instrument.

4384	INDUCTANCE-TYPE DYNAMOMETER MECHANISM	SmE M



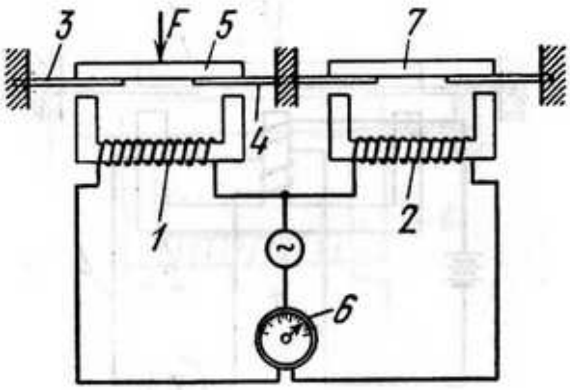
Reactance coil *1* is connected into an a-c circuit with constant voltage and frequency. Force *F*, applied to armature *2*, bends flat springs *3* and *4*, supporting the armature, downward. At this, armature *2* moves downward, reducing the air gap between the armature and the core of coil *1* and, thereby, changing the current in the coil. This current, indicated by ammeter *5*, depends upon the amount armature *2* moves downward. This, in turn, is proportional to force *F*.

4385	INDUCTANCE-TYPE DYNAMOMETER MECHANISM	SmE M



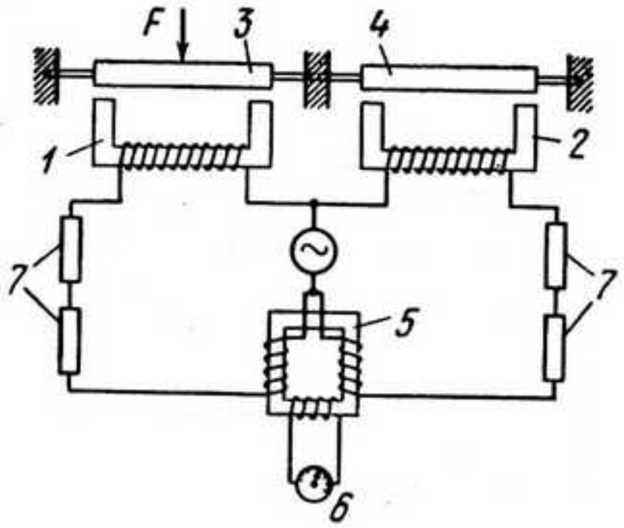
When armature 1 is vibrated by the applied dynamic force F, bending its supporting flat springs, the air gap between the armature and the core of coil 2 varies. Coil 2 has two windings: primary a and secondary b. This motion changes the coefficient of mutual inductance of coil 2. The coefficient is used to measure force F since when primary winding a is supplied by direct current, the a-c voltage in secondary winding b, measured by voltmeter 3, is proportional to the frequency and amplitude of vibration of armature 1, which depend on force F being measured.

4386	INDUCTANCE-TYPE DYNAMOMETER MECHANISM	SmE M



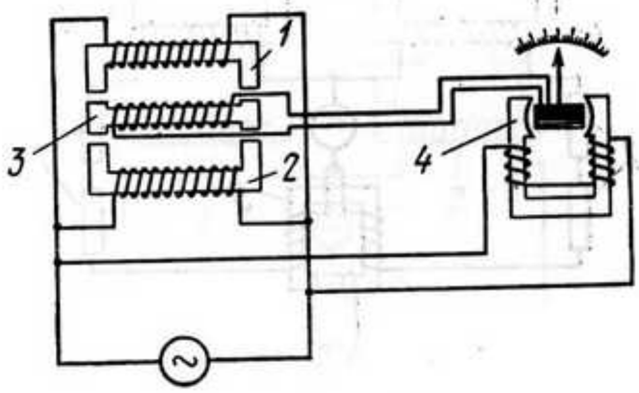
Reactance coils *1* and *2* are connected into an a-c circuit with constant voltage and frequency. Force F, applied to armature *5*, bends flat springs *3* and *4*, supporting the armature, downward. At this, armature *5* moves downward, reducing the air gap between the armature and the core of coil *1*. Consequently, the current in coil *1* is changed. The air gap between armature *7* and the core of coil *2* is maintained constant. The ratio of the two currents is measured by logometer *6*. Owing to the use of two coils, the reading of logometer *6*, indicating the force F to be measured, does not depend upon variations in the voltage and frequency in the circuit.

4387	INDUCTANCE-TYPE DYNAMOMETER MECHANISM WITH A DIFFERENTIAL TRANSFORMER	SmE M



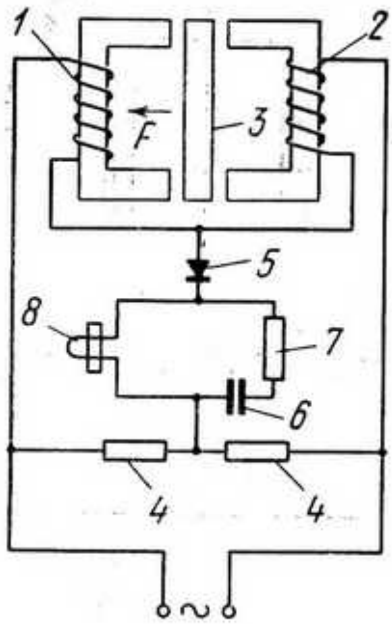
Reactance coils *1* and *2* are connected into an a-c circuit. Force *F*, applied to armature *3*, bends springs, reducing the air gap between the armature and the core of coil *1*. The air gap between armature *4* and the core of coil *2* is maintained constant. Coils *1* and *2* are connected to windings of triple-wound transformer *5* in such manner that measuring instrument *6*, connected to the third winding of the transformer, indicates the difference in the currents in coils *1* and *2*. This difference depends upon the air gap between armature *3* and the core of coil *1*, which, in turn, depends upon the force *F* to be measured. Interchangeable resistors *7* serve to establish the required limits of measurement. Owing to the use of two coils, the reading of instrument *6* does not depend upon variations in the voltage and frequency in the circuit.

4388	INDUCTANCE-TYPE DYNAMOMETER MECHANISM WITH A DOUBLE TRANSFORMER	SmE M



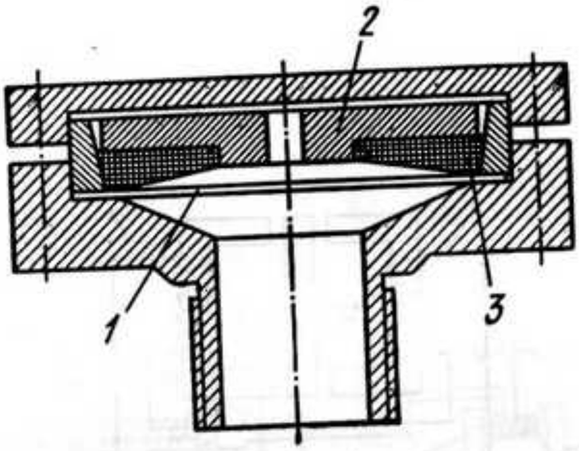
The windings of coils *1* and *2* are connected into an a-c circuit in such manner that they set up magnetic fluxes in opposite directions. Therefore, in the middle position of armature *3* with the secondary winding, the resultant flux equals zero and there is no current in the winding of armature *3*. When armature *3* is displaced by the force to be measured, the fluxes in coils *1* and *2* are no longer equal, a flux is set up in armature *3* that generates an emf in its winding proportional to the displacement of the armature and to the force being measured. The emf induced in the winding of armature *3* can be measured by ferrodynamic instrument *4* having independent excitation.

4389	INDUCTANCE PICKUP MECHANISM OF A DYNAMOGRAPH	SmE M



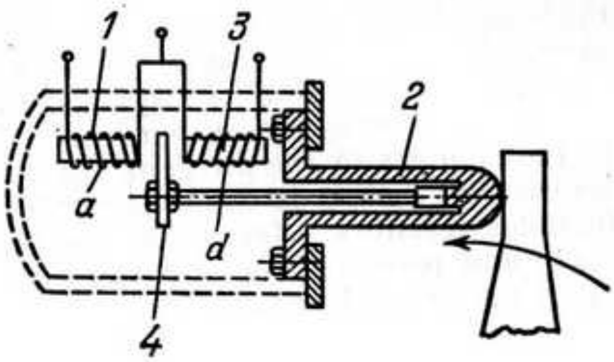
The pickup consists of two cores rigidly attached to each other. Each core has its winding and the two windings, *1* and *2*, constitute a reactance coil. The displacement of armature *3*, located between the cores of windings *1* and *2*, depends upon force *F* to be measured. When armature *3* is displaced to the left, the inductance of winding *1* is increased and that of winding *2* is reduced due to the changes in the air gaps between armature *3* and the two cores. The pickup is connected into an a-c bridge circuit that includes resistors *4* for balancing the bridge, diode *5*, capacitor *6* and resistor *7* for smoothing the pulsation of the alternating current, and loop oscillograph *8*.

4390	INDUCTANCE PICKUP MECHANISM OF A PRESSURE GAUGE	SmE M



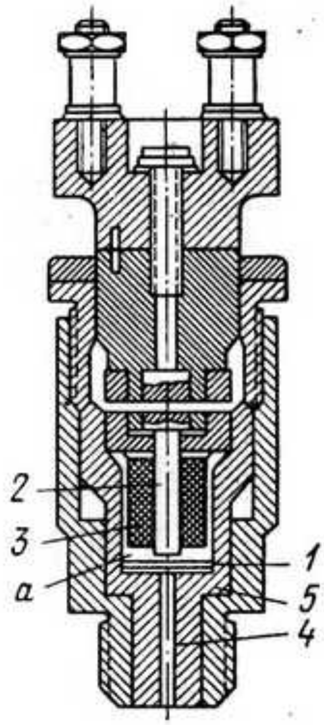
A change in the pressure acting on steel membrane *1* changes the air gap between the membrane and core *2* of coil *3*, which is excited by high-frequency current. The inductance of coil *3* depends upon the air gap and, consequently, on the pressure applied to membrane *1*.

4391	INDUCTANCE PICKUP MECHANISM FOR TORQUE MEASUREMENT	SmE M



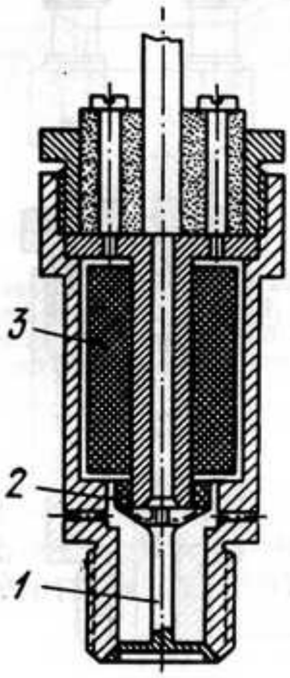
The instrument consists of coils *a* and *d*, wound on cores *1* and *3*, and armature *4* mounted on elastic element *2*. The change in the inductance of coils *a* and *d* is proportional to the change in the air gaps between armature *4* and cores *1* and *3*. This, in turn, is proportional to the compressive strain of elastic tube *2* and, consequently, to the torque applied to the link acting on the tube.

4392	ELECTROMAGNETIC VARIABLE-GAP PRESSURE GAUGE MECHANISM	SmE M



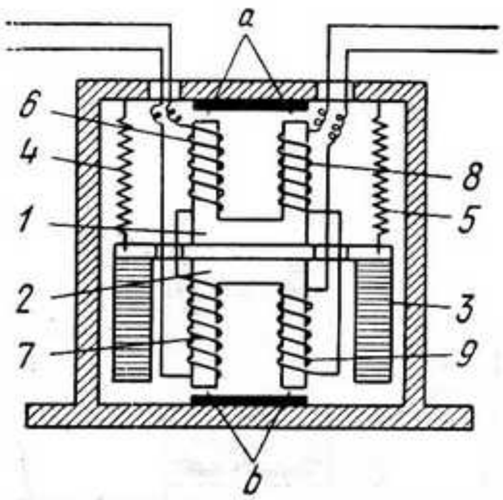
When coil *3* is energized, it sets up a magnetic flux in magnetic circuit *5* and air gap *a* between magnet core *2* and diaphragm *1*. Upon a change in pressure in port *4*, diaphragm *1* is bent upward or downward, varying air gap *a*. This changes the resistance of the magnetic circuit and, consequently, the magnetic flux, inducing an emf in coil *3* proportional to the rate of flux variation. To obtain a quantity at the output of the instrument that is proportional to the pressure being measured, it is necessary to employ an integrating and amplifying device.

4393	MOVING-COIL PRESSURE GAUGE MECHANISM	SmE M



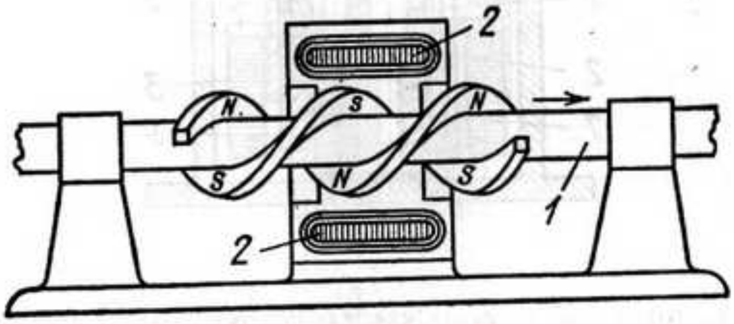
Motion of core *1*, due to a change in the pressure applied to a diaphragm rigidly attached to the core, is transmitted to coil *2*. The emf induced in this coil for a given value of the magnetic flux set up by electromagnet *3* is proportional to the velocity of motion of the coil. To obtain a curve of the pressure it is necessary to amplify the voltage over coil *2*, integrate it and then apply it to the terminals of an oscillograph.

4394	REMOTE-READING ELECTROMAGNETIC VIBROGRAPH MECHANISM	SmE M



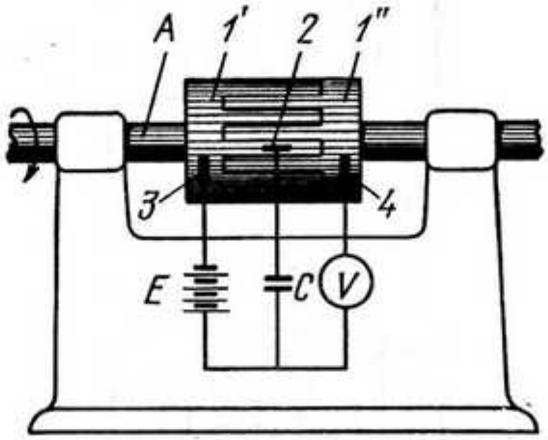
The vibrograph pickup consists of transformers *1* and *2* with air gaps *a* and *b*. The transformers are rigidly mounted on lead ring *3* which is suspended from the housing by means of springs *4* and *5* so that the two air gaps are equal. Primary windings *6* and *7* of the transformers are connected in series; secondary windings *8* and *9* are connected so as to oppose each other, with the undisturbed position corresponding to zero resultant voltage. Vibration of the housing varies the air gaps and, consequently, the magnetic flux varies together with the output voltage. When the air gap of one transformer is reduced and its output voltage increases, the air gap of the other transformer increases and the voltage induced in its secondary winding is reduced. Thus, induced in the secondary windings is a series of modulated waves of voltage of average frequency, whose envelope represents the amplitude of vibration.

4395	CHISTYAKOV REMOTE-READING ELECTRIC PICKUP MECHANISM FOR VELOCITY MEASUREMENT	SmE M



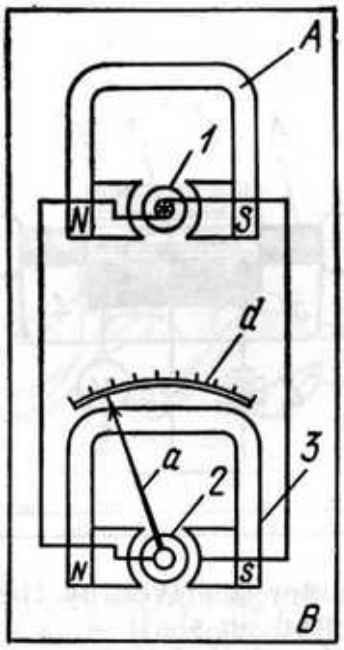
Rotor *1* is a two-pole permanent magnet designed as a cylinder with the poles located along a two-start helix. Upon linear displacement of rotor *1*, an emf is induced in toroidal winding *2*, arranged on an annular core. The induced emf is proportional to the linear velocity of rotor *1*.

4396	PULSE-TYPE TACHOMETER MECHANISM	SmE M



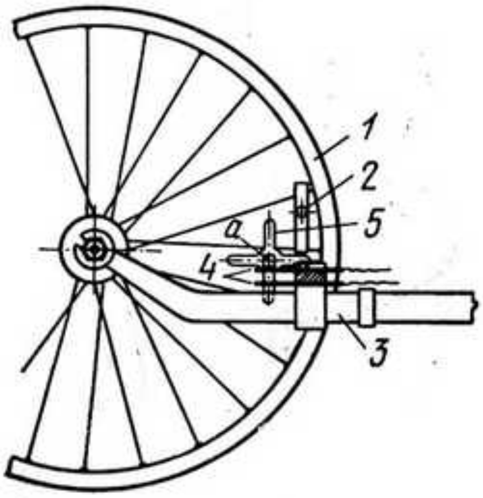
Shaft *A* of the tachometer is driven by the shaft whose speed is to be measured. Mounted on shaft *A* is a commutator consisting of two cylinders, *1'* and *1"*, insulated from each other, which are contacted by brushes *3* and *4*. The commutator is connected into a circuit including power source *E*, magnetoelectric receiver *V* and capacitor *C*. When the commutator rotates, brush *2* connects capacitor *C* alternately to battery *E* (when brush *2* contacts cylinder *1'*) from which the capacitor is charged, and then to receiver *V* (when brush *2* contacts cylinder *1"*), to which the charge is transmitted as a current pulse. The deflection of the hand of the instrument is proportional to the number of pulses per unit time or to the speed (rpm) of the shaft being tested.

4397	REMOTE-READING TACHOMETER MECHANISM	SmE M



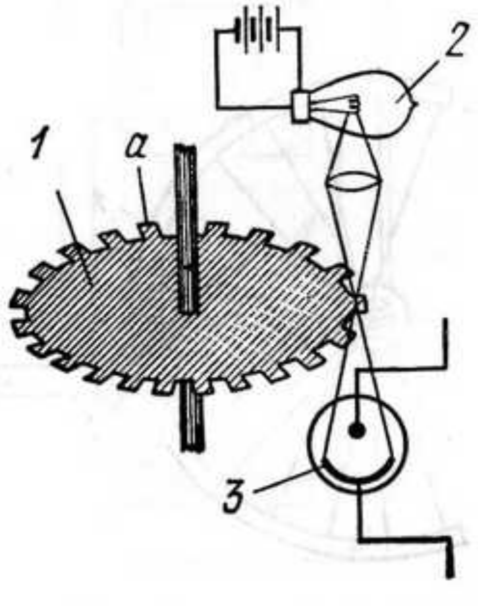
When rotor *1* of generator *A* is driven by the shaft of the motor whose speed is to be measured, the emf induced in the winding of rotor *1* is proportional to its speed of rotation. The voltage of generator *A* is applied to an indicating device—a voltmeter. Armature *2* of the voltmeter is turned due to interaction between the electromagnetic field set up by the current in its winding and the magnetic field of permanent magnet *3*. The angle through which armature *2* and hand *a*, rigidly mounted on the armature, turn is proportional to the voltage over the armature winding and, consequently, to the speed being measured of rotor *1*. The point of hand *a* slides along scale *d*.

4398	WAGON WHEEL REVOLUTION COUNTER MECHANISM	SmE M



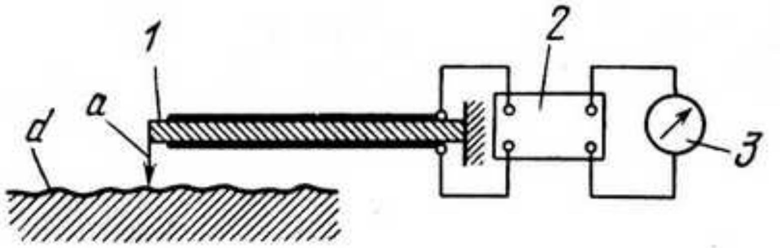
When wheel *1* rotates, pin *2*, secured to the spokes of the wheel, strikes the teeth of sprocket *5* whose axle is rigidly mounted on fork *3*. Sprocket *5* has square *a* which closes contacts *4* each time the sprocket turns one fourth of a revolution, i.e. per revolution of wheel *1*. Therefore, each revolution of the wheel corresponds to one current pulse.

4399	PULSE TRANSMITTER MECHANISM FOR MEASURING ANGULAR SPEEDS	SmE M



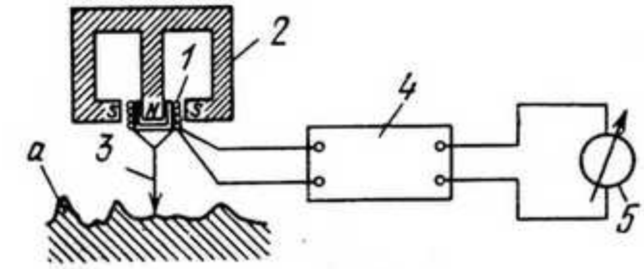
Teeth a are equally spaced on the periphery of counter disk 1, which rotates at a speed proportional to the quantity being measured (power, force or stress). Light source 2, arranged above disk 1, illuminates phototube 3. When disk 1 rotates, the beam of light from source 2 is interrupted by teeth a, so that phototube 3 is subject to pulsating light with the frequency of pulsation depending upon the speed of rotation of disk 1.

4400	PIEZOELECTRIC PROFILOMETER MECHANISM	SmE M



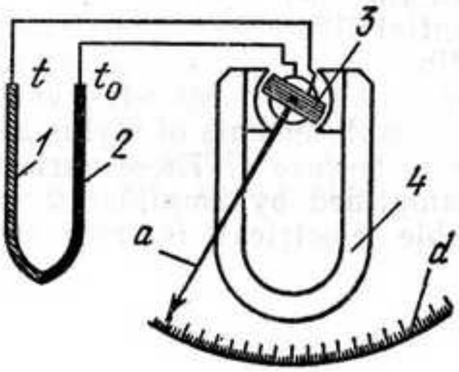
Crystalline element *1*, of Rochelle salt, has the shape of a plate fixed at one end. This element is subject to bending by the action of stylus *a* as it traces over surface *d* whose roughness is to be determined. Owing to the piezoelectric effect, electric charges are developed on the metal electrodes of the crystal at the faces of the crystalline plate. These charges are strictly proportional to the deformation, i.e. to the deflections of the free end of the plate. These, in turn, are equal to the vertical displacements of stylus *a*. At a definite value of the electric capacitance between the electrodes of the crystal, the electrodes set up a potential difference proportional to the charge. As stylus *a* moves continuously along surface *d* being inspected, the potential difference over the electrodes varies continuously, in proportion to the displacements of stylus *a*, i.e. to the ordinates of the profile of surface *d*. These variations in potential difference can be amplified by amplifier *2* and measured by suitable electrical instrument *3*.

4401	**ELECTRODYNAMIC PROFILOMETER MECHANISM**	SmE M



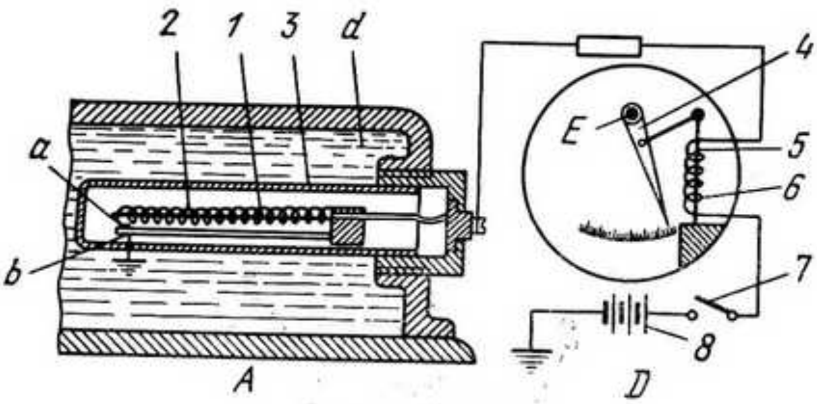
Movable cylindrical coil 1, wound with a large number of turns of copper wire, moves in the radial magnetic field set up in the air gap of permanent magnet 2 in accordance with the axial motion of stylus 3, rigidly secured to coil 1. Stylus 3 is moved at constant speed along surface *a* being inspected. This induces an emf in coil 1, which is proportional to the velocity of its displacement. This emf in the coil is transmitted through amplifier 4 to electric measuring and recording instrument 5.

4402	**THERMOCOUPLE PYROMETER MECHANISM**	SmE M



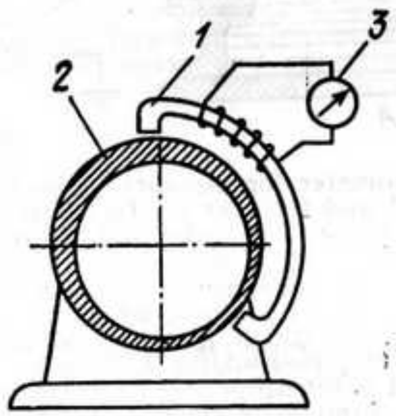
A thermoelectromotive force is developed in a circuit consisting of two unlike metal conductors, 1 and 2, because temperatures t and t_0 at the ends of conductors 1 and 2 are not equal. Current is set up by thermocouple 1-2 in movable coil 3, turning freely in the field of strong permanent magnet 4. Attached rigidly to coil 3 is hand *a* which indicates on scale *d* the temperature of the hot junction of conductors 1 and 2. Hand *a* is returned to its initial position by a spring (not shown).

4403	THERMOPULSE THERMOMETER MECHANISM	SmE M



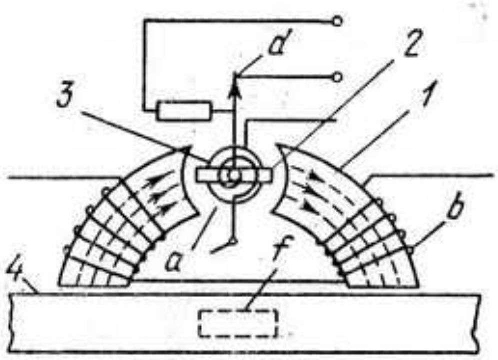
The thermopulse thermometer for measuring the temperature of liquid *d* comprises transmitter *A* and receiver *D*. Transmitter *A* consists of shell *3* in which a contacting device is mounted. This device is made up of fixed contact *b* and movable contact *a*, secured on insulated bimetallic strip *1* having winding *2*. One end of winding *6* is connected to winding *2*. Winding *6* is arranged on bimetallic strip *5*, which is linked to hand *4*, turning about fixed axis *E*. Through ignition switch *7*, the other end of winding *6* is connected to power source *8*. When switch *7* and contacts *a* and *b* are closed, current is set up in coil *2* of transmitter *A* and winding *6* of receiver *D*. At this, bimetallic strip *1*, heated by the current in its winding *2*, bends upward, opening contacts *a* and *b* and breaking the circuit so that there is no longer current in the transmitter coil and, consequently, in the receiver coil. As it cools, bimetallic strip *1* straightens out, closing contacts *a* and *b*. The heating and, consequently, deformation of bimetallic strip *5* of receiver *D* correspond to the current pulses transmitted by the closing and opening of contacts *a* and *b* in transmitter *A*. The frequency of pulsation of contacts *a* and *b* and, therefore, the length of the current pulses in winding *6* depend on the heating of strip *1* by current in its winding, as well as on the temperature of the surrounding medium *d*. When this temperature is lower, bimetallic strip *1* cools faster after opening contacts *a* and *b*. Owing to the consequently shorter time during which contacts *a* and *b* are in the open state, the number of current pulses increases. Therefore, the average current in winding *6* of receiver *D* increases with a reduction in the temperature of surrounding medium *d*. This increases the deformation of bimetallic strip *5* and the deflection of hand *4* linked to the strip. The scale along which hand *4* moves is graduated in temperature units.

4404	ELECTRIC FLAW DETECTOR MECHANISM FOR PIPE INSPECTION	SmE M



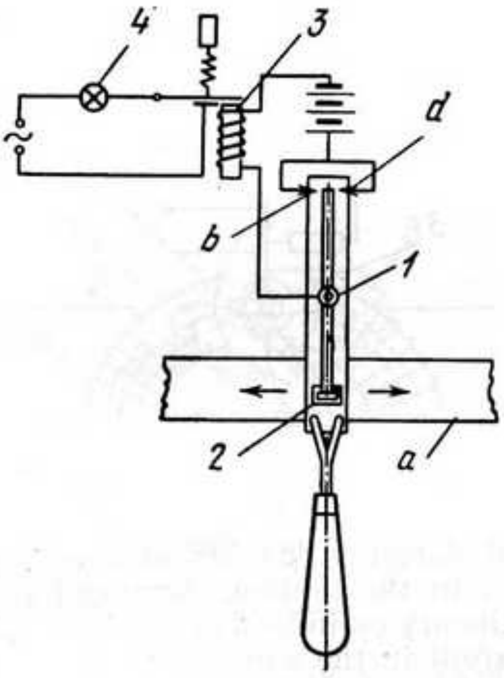
If there are flaws inside the pipe or the wall is of unequal thickness, the magnetic flux varies in electromagnet *1* as it travels along revolving pipe *2*. This produces an emf in the winding of electromagnet *1* so that the hand of galvanometer *3* is deflected, indicating the flaw.

4405	MAGNETOELECTRIC (MOVING-COIL) FLAW DETECTOR MECHANISM	SmE M



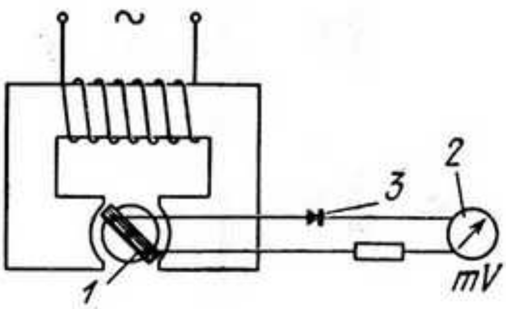
This moving-coil detector consists of arc-shaped core *1* with cylindrical gap *a* in the middle. Arranged in gap *a* is rotary frame *2* with stationary cylinder *3* of soft iron at its centre. There is an electric current in the winding of frame 2. The current in winding *b* of core *1* is selected so that, at a given current in frame *2*, hand *d*, rigidly mounted on the frame, indicates zero. The detector is moved along workpiece *4* being inspected. When the detector passes a defective spot (flaw) *f*, hand *d* is violently deflected. Hand *d* is provided with a contacting device for closing the circuit of a signalling instrument.

4406	PONDEROMOTIVE (MECHANICAL-PRESSURE) FLAW DETECTOR MECHANISM	SmE M



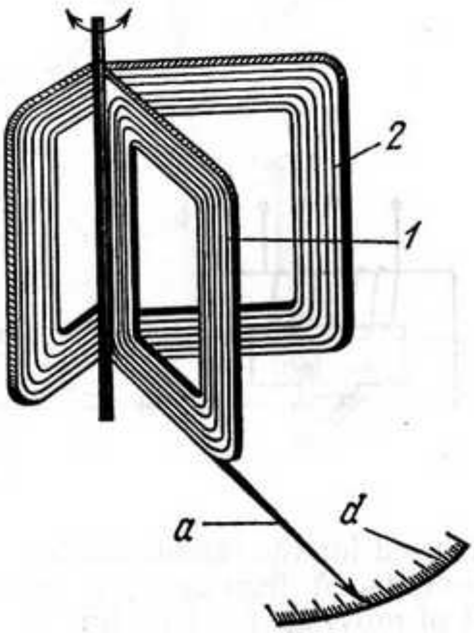
The mechanism travels along magnetized speciment *a* being inspected so that the direction of the magnetic flux is perpendicular to hand *1*. As the mechanism passes a flaw in the specimen, forces of attraction, developed by stray fluxes, act on armature *2*, consisting of a stack of sheet transformer steel and secured to the end of hand *1*. This causes a double deflection of hand *1*, first in the direction of detector travel and then in the opposite direction. This closes the contacts at *d* and at *b* consecutively and, by means of auxiliary relay *3*, lights signal lamp *4*.

4407	REMOTE-READING MUTUAL INDUCTANCE PICKUP MECHANISM	SmE M



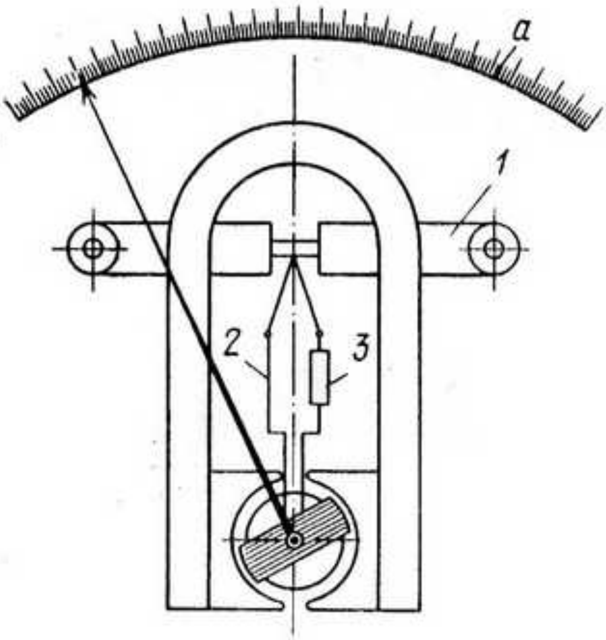
The mechanism is used for the remote indication of the readings of pointer instruments. A ferrodynamic system serves as the pickup. The shaft of moving coil *1* is rigidly linked to the shaft of the instrument whose reading is to be indicated. The arrow of the instrument is mounted rigidly on this shaft. When the arrow turns, the emf induced in coil *1* is measured by moving coil millivoltmeter *2*, connected into the coil circuit through diode *3*.

4408	ELECTRODYNAMIC AMMETER MECHANISM	SmE M



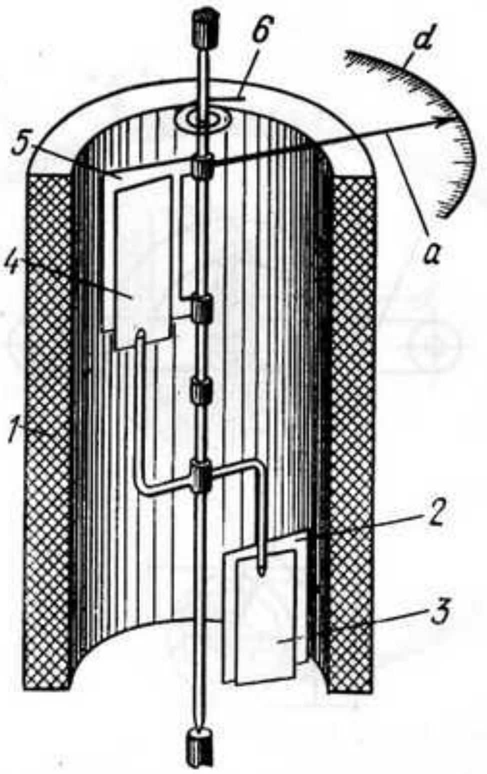
The electrodynamic design is based on the principle of the interaction of two electromagnetic fields set up by current in coils *1* and *2*. Upon a current in coils *1* and *2*, moving coil *1* turns with respect to fixed coil *2*. The angle through which the coil turns, indicated on scale *d* by hand *a* mounted on coil *1*, depends upon the current in the coils. The nature of scale *d* is determined by the magnetic interaction of the moving and fixed coils, and depends upon their shape. To obtain a scale with equal divisions, fixed coil *2* is bent at an angle of about 135° and moving coil *1* turns about one edge like the page of a book.

4409	THERMOCOUPLE AMMETER MECHANISM	SmE M



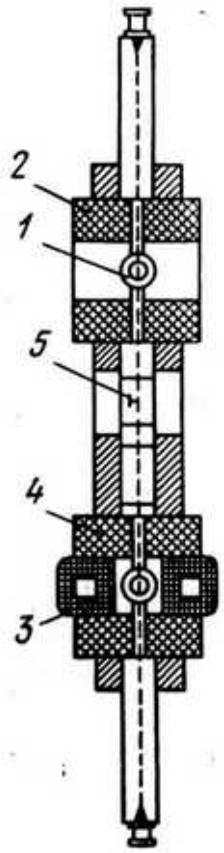
When heater *1* is energized, heat is evolved that raises the temperature of the junction of thermocouple *2-3*. As a result, a thermoelectromotive force is set up in the thermocouple circuit and is measured by a sensitive moving-coil instrument. Since the thermoelectromotive force is a definite function of the electric current in heater *1*, scale *a* of the instrument can be graduated directly in units of current.

4410	ELECTROMAGNETIC AMMETER MECHANISM	SmE M



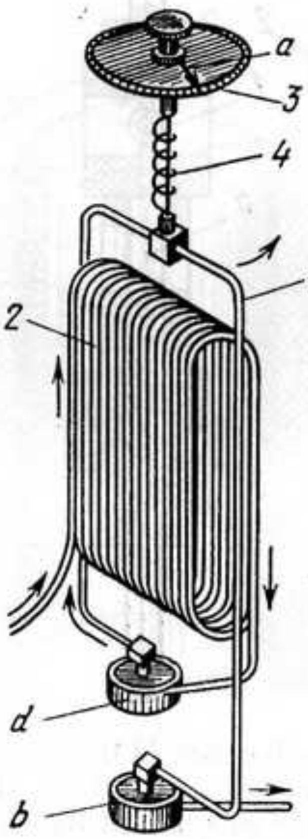
When coil *1* of the electromagnet is energized, the core, located inside coil *1*, turns, also turning hand *a*. Two magnetic systems are provided to increase the angle through which the hand turns along scale *d*. These systems are connected in series so that moving core *3* of the first system, repelled by fixed core *2*, turns core *4* of the second system. Moving core *5* of the second system, rigidly secured to hand *a*, is repelled by core *4*. Spiral spring *6* returns the systems to the initial position.

4411	COMPENSATED DYNAMOMETER WATTMETER MECHANISM	SmE M



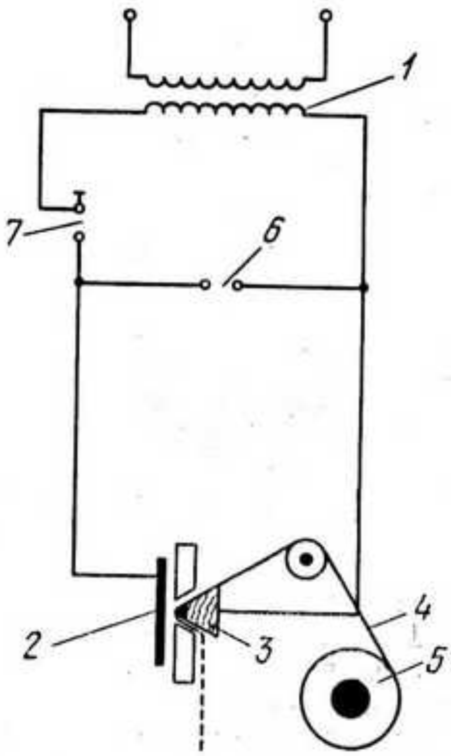
The principle of this mechanism is based on the tight interweaving of a-c and d-c windings, with the latter compensating for a large part of the torque developed by the alternating current. Moving coil *1* and fixed coil *2* have two windings each. The windings are insulated from each other but are so tightly interwoven that with an equal number of ampere-turns they set up magnetic fields that are equal in strength and distribution in space. The direction of the direct current in the windings is such that the developed torque is opposed to the torque of the a-c windings. If these torques are not absolutely equal, mirror *5* is deflected and the power difference can be read off by means of an optical device (not shown). To establish astaticism of the wattmeter, two compensating coils, *3* and *4*, are connected in series with coils *1* and *2*.

TORSIONAL ELECTRODYNAMOMETER MECHANISM



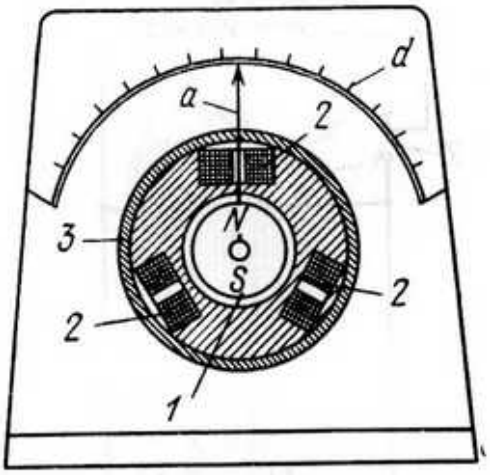
When coils *1* and *2* are energized, moving coil *1* turns through an angle indicated by hand *a* of torsional head *3*, linked to moving coil *1* by spring *4*. The torque is proportional to the square of the current in coils *1* and *2*. Moving coil *1* consists of a single turn and is connected in series with fixed coil *2*. Current is conducted through two cups, *d* and *b*, filled with mercury.

4413	SPARK RECORDER MECHANISM	SmE M



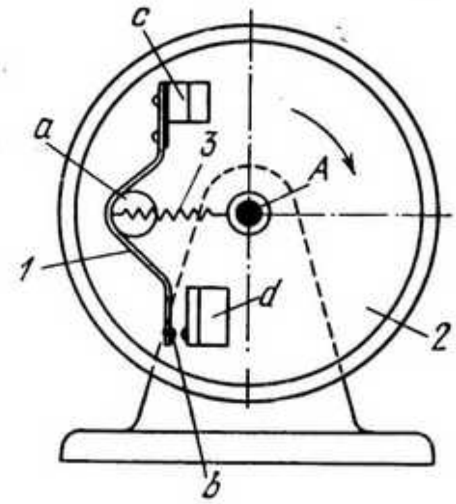
The mechanism is intended for recording rapidly varying phenomena. Sparks obtained from inductor *1* in the spark gap between upper electrode *2* and guide electrode *3* burn a series of holes in paper strip *4*, which is drawn by drive roller *5* through the spark gap. If the sparks follow one another sufficiently frequently, the holes in paper strip *4* merge into a line. Included in the circuit are protective gap *6* and, in series, spark gap *7*.

4414	THREE-COIL MOVING-MAGNET LOGOMETER MECHANISM	SmE M



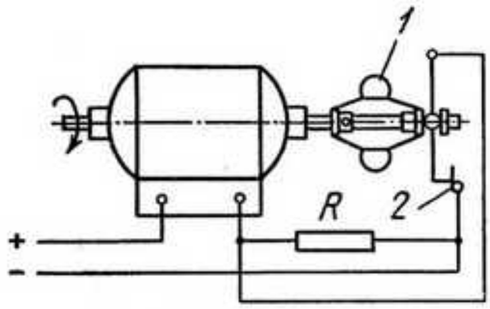
Magnet *1*, to which hand *a* is rigidly secured, is located inside three coils *2*, spaced at 120°. Outside, coils *2* and magnet *1* are surrounded by a screen of soft iron designed in the form of a cylinder. When the windings of coils *2* are energized, magnet *1* and hand *a* turn. The principle of the logometer is based on the property of a turning magnet to align itself with the resultant vector of the magnetic field set up by energized coils *2*. By varying the ratios and directions of the currents in the windings, a sufficiently large angle of scale *d* can be obtained. This is of prime importance for certain instruments, for instance, a remote-reading compass.

4415	ELECTRIC CONTROLLER MECHANISM	SmE Rg



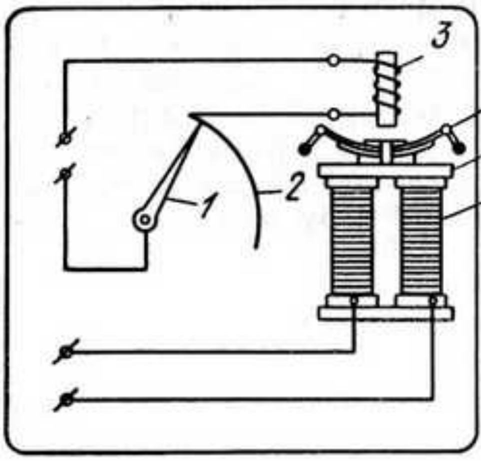
Weight a is secured to bent metal strip 1, which has contact b at one end and is rigidly attached at the other end to disk 2, rotating about fixed axis A. When the angular velocity of disk 2 is increased, weight a, owing to centrifugal force, overcomes the resistance of spring 3 and moves outward, opening the circuit at contact b and switching off the rotating drive. This reduces the speed of disk 2, spring 3 pulls weight a inward again and closes the circuit at contact b. Current is conducted to contact plates c and d by means of a collector.

4416	**CENTRIFUGAL GOVERNOR MECHANISM FOR ELECTRIC MOTOR SPEED CONTROL**	SmE Rg



At normal speed of the electric motor, resistor R is cut out and the motor is directly connected to the power mains. When the load drops and the motor speed increases, centrifugal governor *1* opens the circuit that shorts the resistor at contact *2*. This reduces the power supplied to the electric motor.

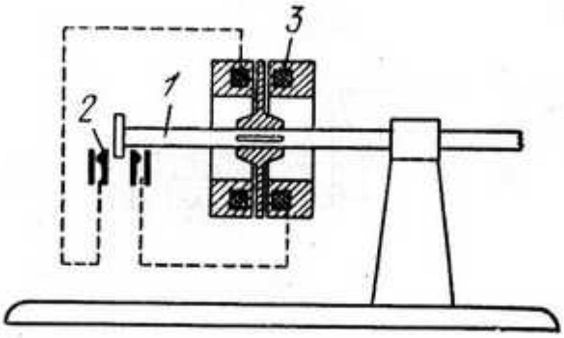
4417	**CARBON-PILE REGULATOR MECHANISM**	SmE Rg



When lever *1* of rheostat *2* is turned, the voltage is changed over the winding of electromagnet *3*. Armature *4* is attracted to the core of electromagnet *3*, compensating for the force exerted by leaf springs *6*. This changes the compression acting on the carbon piles and, consequently, the resistance of carbon rheostat *5*, which is connected into the circuit of the device being controlled.

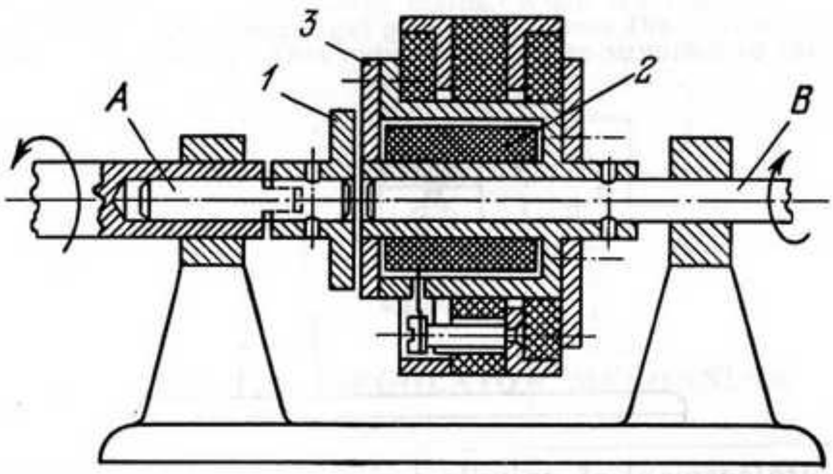
5. CLUTCH AND COUPLING MECHANISMS
(4418 through 4422)

4418	REVERSING CLUTCH ENGAGING MECHANISM	SmE C



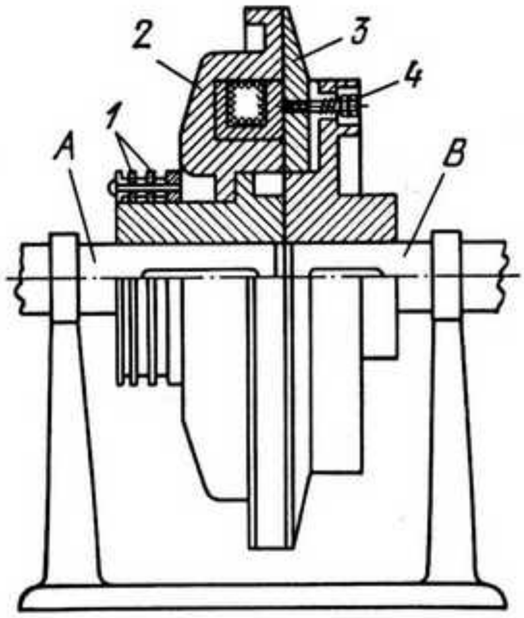
Axial displacement of spindle *1* closes one or the other pair of contacts *2* in the circuits of an actuator mechanism which reverses the electromagnetic controls of clutch *3* and the clutch itself.

4419	MAGNETIC CLUTCH MECHANISM	SmE C



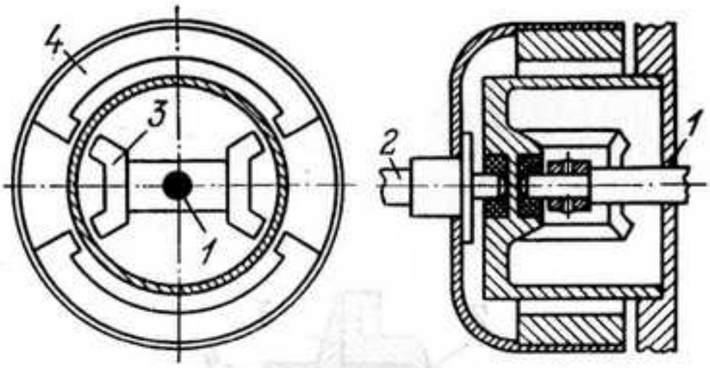
When armature *1*, designed as a disk and rigidly mounted on the sliding section at the end of shaft *A*, is attracted by electromagnet *2*, the armature is forced against friction ring *3*. This engages the clutch and transmits rotation to driven shaft *B*.

MAGNETIC CLUTCH MECHANISM



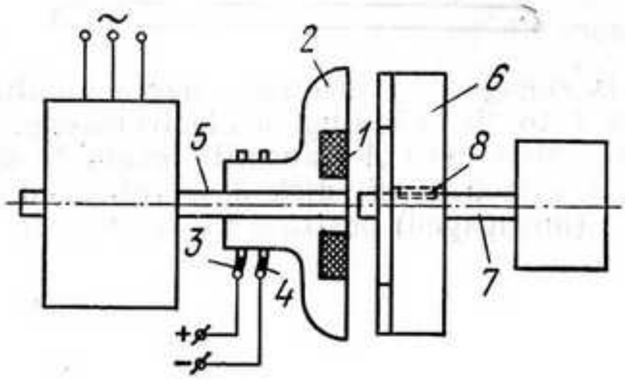
The clutch is engaged by electric current conducted through contact rings *1* to the winding of electromagnet *2*, which attracts disk *3* so that shaft *A* transmits torque to shaft *B*. When the current is switched off, disk *3* is retracted to its initial (unengaged) position by springs *4*.

4421	MAGNETIC COUPLING MECHANISM	SmE C



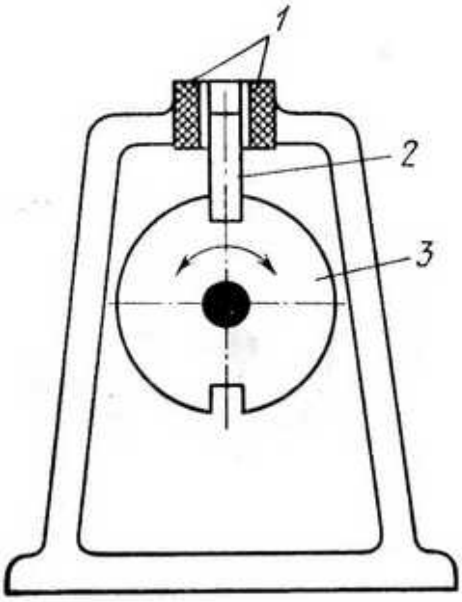
When shaft *1* rotates together with permanent magnets *3*, mounted rigidly on the shaft and enclosed in an airtight housing, armature *4* and shaft *2*, on which the armature is rigidly mounted, also rotate.

4422	NONREVERSIBLE MAGNETIC CLUTCH MECHANISM	SmE C



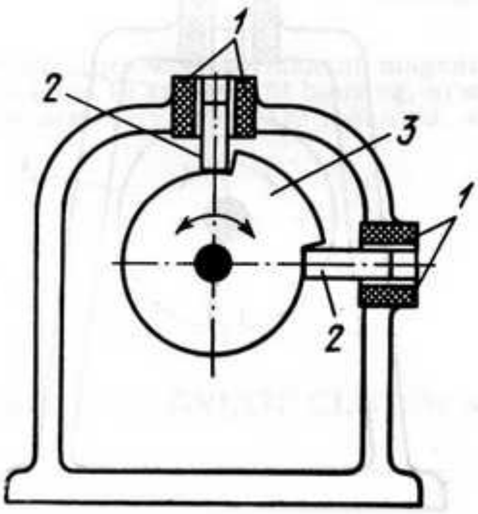
Iron core *2* is secured to the driving member of the clutch, which is keyed to shaft *5* of the electric motor. When winding *1* of the driving member is energized by current through contact rings *3* and *4*, driven member *6* of the clutch, linked by sliding key *8* to driven shaft *7*, is attracted to core *2*. This engages the clutch, developing the fricion force required to transmit the motor torque to shaft *7*.

4423	ELECTRIC STOP MECHANISM	SmE SD



When the winding of solenoid *1* is energized, core *2* of the solenoid is pulled upward and disk *3* rotates freely. When the winding is de-energized, core *2* drops downward and stops disk *3*.

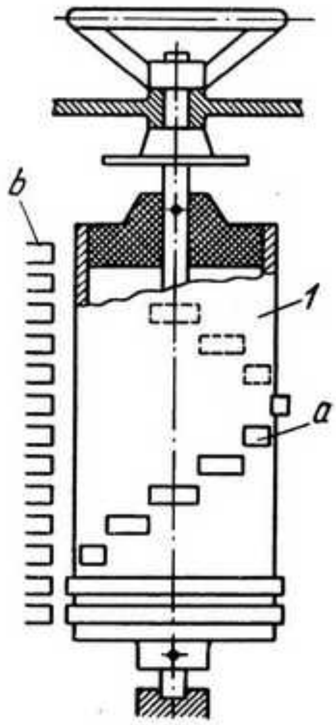
4424	ELECTRIC STOP MECHANISM	SmE SD



When the windings of solenoids *1* are energized, cores *2* of the solenoids are pulled into them and disk *3* rotates freely. When the windings are de-energized, cores *2* stop the rotation of disk *3* in either direction.

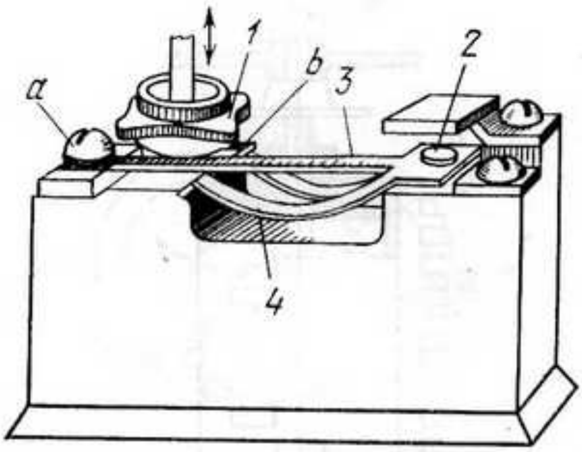
7. SWITCHING, ENGAGING AND DISENGAGING MECHANISMS (4425 through 4430)

4425	RHEOSTAT STAGE DRUM SWITCH MECHANISM	SmE SE



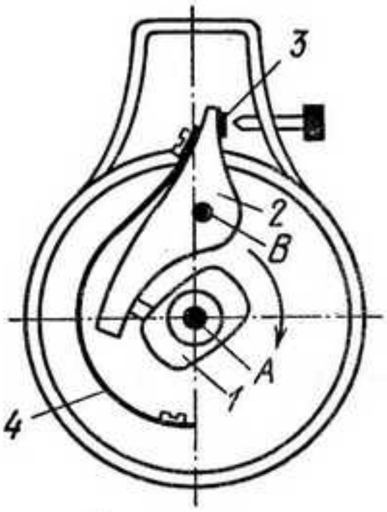
When drum *1* is turned, movable contacts *a* slide along fixed contacts *b*, closing the circuits of the stages in a rheostat.

4426	SPRING-TYPE SNAP MICROSWITCH MECHANISM	SmE SE



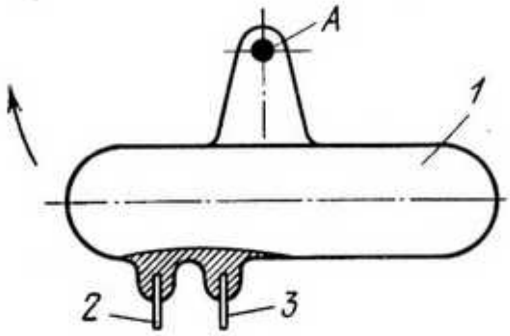
The mechanism of the microswitch provides for instantaneous closing and opening of contacts *2* at a small movement of pushbutton *1*. The spring-type contact lever consists of three components. Middle component *3* is attached to the base by screw *a*. The two outer shortened springs *4* are integral at their right ends with component *3* and their left ends fit into V-slots *b*. They flip over middle component *3* even at a very small movement of pushbutton *1*.

CAM-OPERATED MAGNETO INTERRUPTER MECHANISM



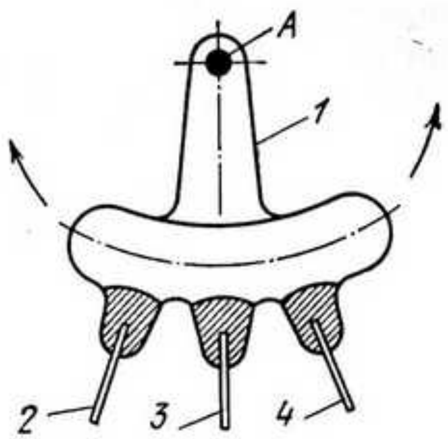
When cam *1* rotates about fixed axis *A*, breaking lever *2*, oscillating about axis *B*, closes the circuit at contact *3*. Lever *2* is retracted and the circuit is opened by spring *4*.

4428	MERCURY SWITCH MECHANISM	SmE SE

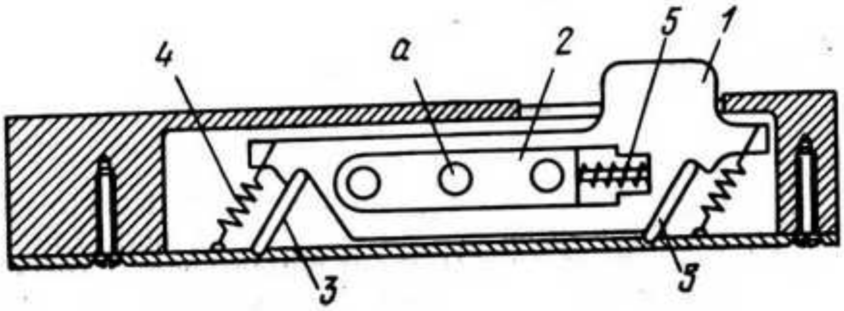


In the position shown, contacts *2* and *3* are closed. When bulb *1* with mercury (shown hatched) is tipped about fixed axis *A*, contacts *2* and *3* are opened.

4429	MERCURY SWITCH MECHANISM	SmE SE

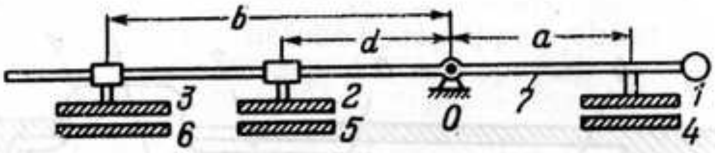


When bulb *1* with mercury (shown hatched) is tipped clockwise about fixed axis *A*, contacts *3* and *4* are closed. When it is tipped counterclockwise, contacts *3* and *4* are opened and contacts *2* and *3* are closed.



When contacting bar *1* is pushed to the left and right, electric current is switched on and off by means of movable contacts *a* on the bar and fixed contacts inside the switch housing. Bar *1* is insulated and carries contacts *a*. It is mounted on two rocking plates *3* and is held in its extreme positions by toggle springs *4*. To speed up contact breaking, holder *2* of contacts *a* can slide slightly in a slot of bar *1* and is loaded by spring *5* arranged between holder *2* and the end of the slot in bar *1*.

4431	UNIVERSAL ELECTRODYNAMIC ANALOG COMPUTING MECHANISM	SmE MO



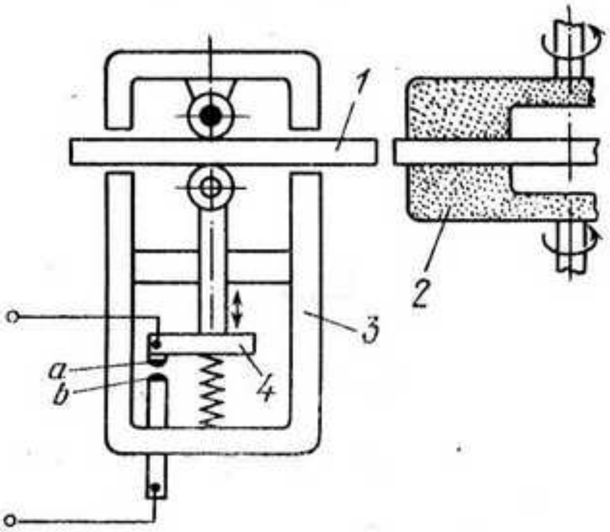
The mechanism is based on the principle of the Kelvin balance on whose beam *7* three coils, *1*, *2* and *3*, are fastened at distances of a, d and b from fixed axis O about which beam *7* turns. Distance a is constant; distances d and b are variable. Located respectively under coils *1*, *2* and *3* are fixed coils *4*, *5* and *6*. Coils *2* and *3* are adjusted linearly pairwise, simultaneously with coils *5* and *6* by a special device (not shown). The conditions of equilibrium of the system are expressed by the equation

$$ai_1i_4 = di_2i_5 \pm bi_3i_6$$

where i is the current in the coils. Combining various currents in coils *1*, *2*, *3*, *4*, *5* and *6*, and varying distances d and b, various relationships can be obtained, enabling algebraic addition, multiplication and division to be performed.

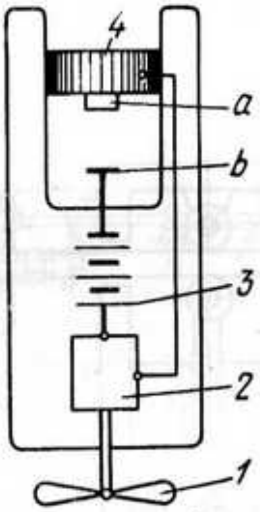
9. MECHANISMS OF OTHER FUNCTIONAL DEVICES
(4432 through 4450)

4432	ELECTRIC-CONTACT AUTOMATIC SIZING MECHANISM FOR GRINDING	SmE FD



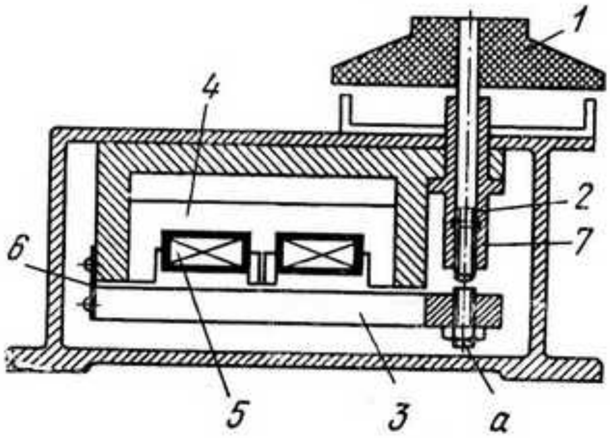
Workpiece *1*, ground by wheels *2*, enters the measuring system of automatic sizing device *3*, which has electric-contact head *4*. Upon wheel wear, the size of the workpiece approaches the upper limit of tolerance, i.e. the maximum permissible thickness, and head *4*, by closing contacts *a* and *b*, switches on a mechanism that adjuss the positions of grinding wheels *2* (brings them closer together).

4433	DEPTH CONTROL ELECTRIC-CONTACT MECHANISM FOR SURFACING MINES	SmE FD



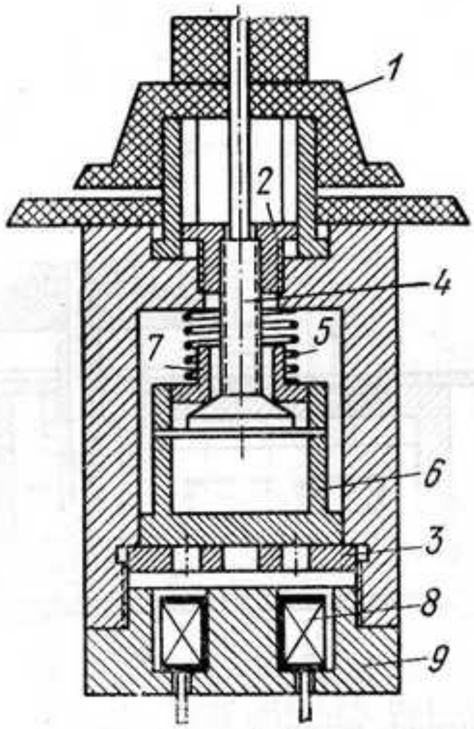
The mine has propeller *1* with a vertical axis, which is driven by electric motor *2* supplied from storage battery *3*. The motor is switched on by movable piston *4*. On top, piston *4* is subject to the pressure of the water; underneath (inside), to the pressure of air contained in an airtight vessel. As the mine sinks deeper and deeper in the sea, piston *4* moves downward because of the increasing difference of pressure above and below it. When the depth of submergence reaches the preset value, contacts *a* and *b* are closed, electric motor *2* starts and the mine begins to rise slowly. Before the mine reaches the surface, piston *4*, moving upward, opens contacts *a* and *b*, switching off motor *2*. Thus the mine sinks and rises repeatedly until the storage battery is exhausted.

4434	SCREW-TYPE PICKUP SETTER MECHANISM	SmE FD



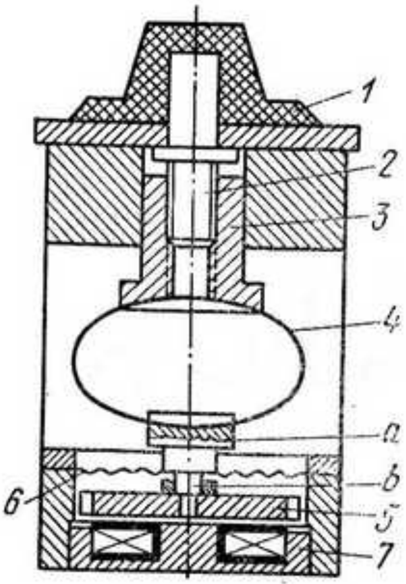
When dial *1* is turned, screw *2* is screwed into threaded hole *7*. Screw *2* displaces stop screw *a* of armature *3*, changing the air gap between the armature and magnetic circuit *4* of coil *5*. Armature *3* is linked to magnetic circuit *4* by flat spring (reed) *6*. The setter is used to adjust the air gap between armature *3* and magnetic circuit *4*.

4435	SCREW-TYPE PICKUP SETTER MECHANISM	SmE FD



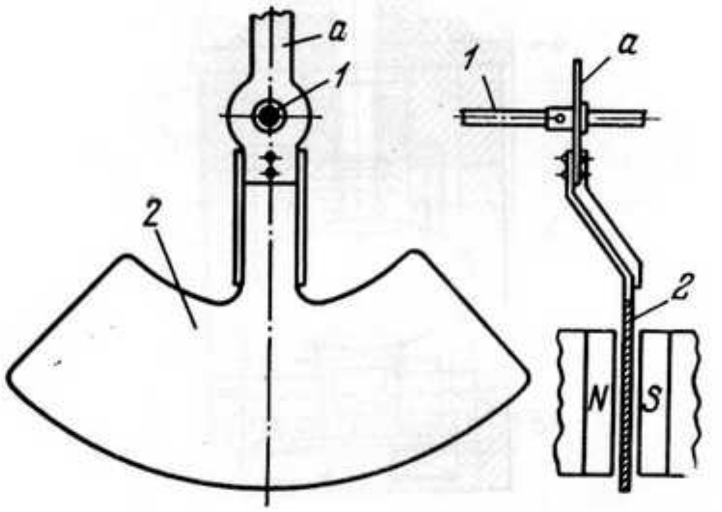
When dial *1* is turned, it screws nut *2* into the housing with its outside thread. Screw *4*, engaging the inner thread of nut *2*, is held against rotation by spring *5* acting through bushing *7*. The inside and outside threads of nut *2* have different pitches. Thus, when dial *1* is turned one revolution, screw *4* moves axially a distance equal to the difference of the two pitches, providing fine adjustment. Moving together with screw *4* are sleeve *6* and armature *3*, thereby changing the air gap between the armature and magnetic circuit *9* of coil *8*. This varies the inductance of coil *8*. The setter is used to adjust the air gap between armature *3* and magnetic circuit *9*.

4436	SCREW-TYPE ELASTIC-LINK PICKUP SETTER MECHANISM	SmE FD



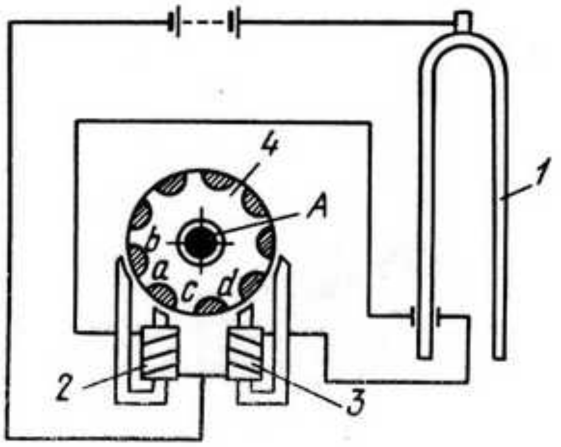
When dial *1* is turned, screw *2* displaces nut *3* vertically. Oval spring *4*, clamped between nut *3* and anvil *a*, transmits force to pin *b* of armature *5*, which is suspended from membrane *6*. Owing to the unequal rigidity of spring *4* and of membrane *6*, armature *5* is displaced considerably less than nut *3*, providing, thereby, extremely fine adjustment of the air gap between armature *5* and magnetic circuit *7*.

4437	MAGNETIC VIBRATION DAMPER MECHANISM FOR INDICATING INSTRUMENTS	SmE FD



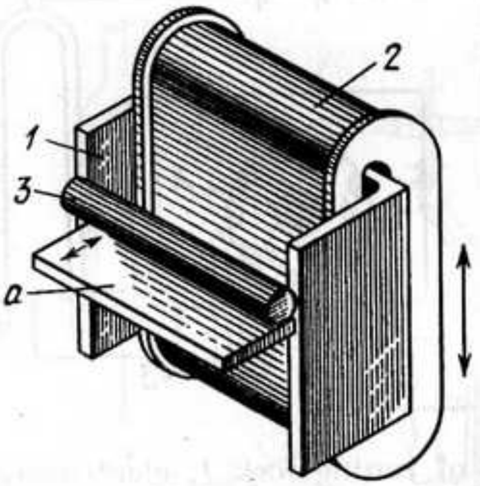
The vibration of hand a, rigidly mounted on shaft 1, is damped upon the motion of segment-shaped conductor 2 in a magnetic field. A part of the energy causing vibration of shaft 1 with hand a is spent in inducing a current in conductor 2.

4438	PHONIC WHEEL MECHANISM	SmE FD



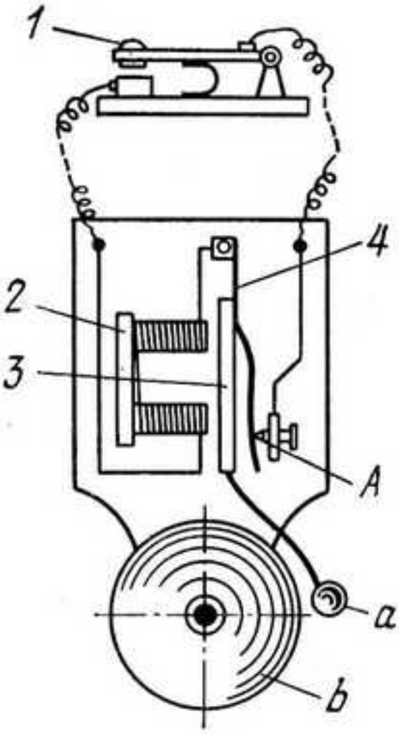
Upon oscillation of tuning fork *1*, electromagnets *2* and *3* are alternately energized. When electromagnet *2* is energized, its poles attract lugs *a* and *b* of wheel *4*, turning the wheel through a certain angle about fixed axis *A*. During this time, lugs *c* and *d* approach the poles of electromagnet *3*. After this, electromagnet *2* is de-energized and electromagnet *3* is energized so that its poles attract lugs *c* and *d*, continuing to turn wheel *4* in the same direction (counterclockwise).

4439	ELECTROMAGNETIC TURNING MECHANISM FOR WORKPIECE INSPECTION	SmE FD



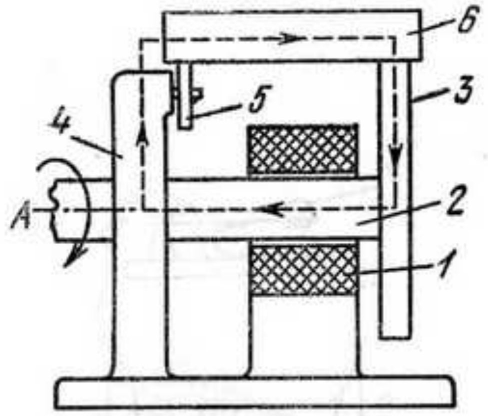
An electromagnet, consisting of channel-shaped core *1* with winding *2*, attracts workpiece *3*, being inspected and lying on measuring surface *a*. As the electromagnet moves downward, workpiece *3* is rotated and, after the full downward stroke of the electromagnet, drops off the measuring surface.

4440	ELECTRIC BELL MECHANISM	SmE FD



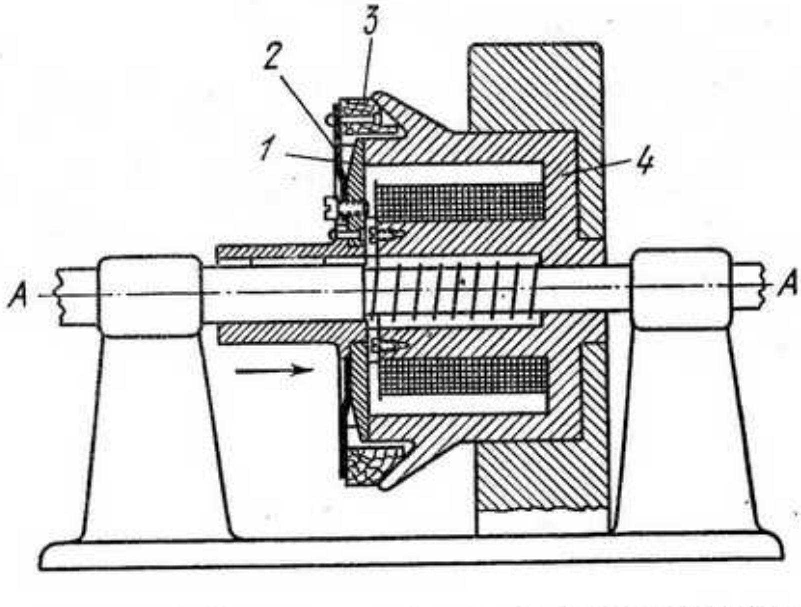
When button *1* is pressed, the electric circuit is closed. This energizes the winding of electromagnet *2*, attracting armature *3* so that hammer *a* strikes the rim of bell *b*. This motion of the armature breaks the circuit at point *A*, de-energizing the electromagnet and allowing spring *4* to retract the armature to its initial position in which the circuit is closed again. Thus, as long as pushbutton *1* is held down, armature *3* is alternately attracted and released by electromagnet *2* so that hammer *a* strikes bell *b* with rapidly repeated blows.

4441	**ELECTROMAGNETIC TURNING MECHANISM**	SmE FD



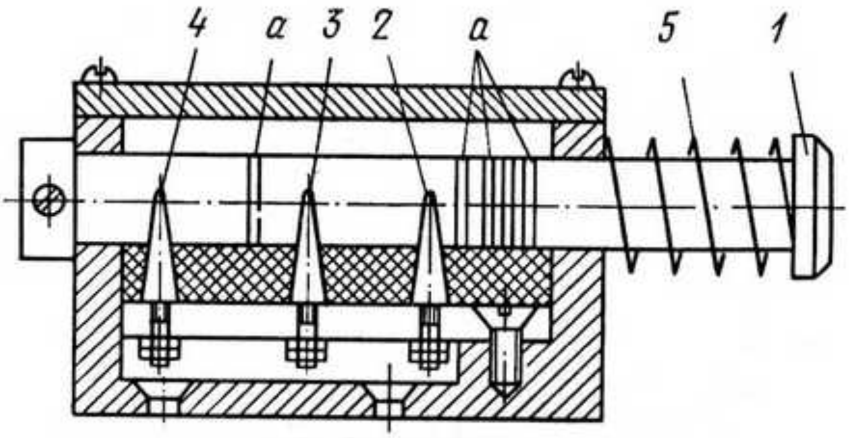
Core 2, carrying disk 3, rotates about fixed axis A within fixed winding 1. Fixed upright 4 has a pin on which roller 5 is mounted. Workpiece 6 which is to be turned, rests on roller 5 and disk 3, thereby closing the magnetic circuit.

4442	**TELEGRAPH APPARATUS BRAKING MECHANISM**	SmE FD



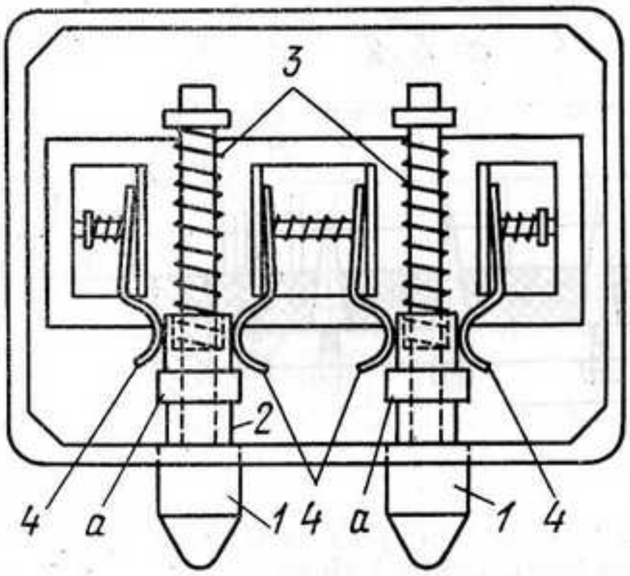
When armature 1, which can move along axis A-A on a feather key, is attracted by the electromagnet, annular spring 2, secured to armature 1, forces shoes 3 against rim 4 and produces the braking effect.

4443	ELECTRIC-CONTACT CONTROLLER MECHANISM FOR MULTIPLE MACHINE TOOL OPERATION	SmE FD

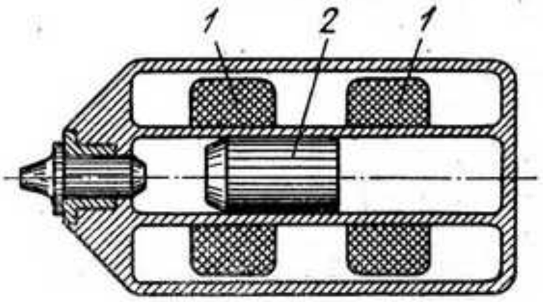


When bar *1* is moved axially (by a slide or other travelling unit of the machine tool), contact rings *a* engage contacts *2*, *3* and *4* in a certain preset sequence. Contact *2* switches on a signal lamp of the main control panel, indicating the number of the particular machine tool in which the operation is about to end. The signal lamp begins to blink a short time before the end of the operation because several contact rings *a* on bar *1* are closely spaced. Contact *4* switches on a signal indicating the end of the operation. Contact *3* disengages the feed and switches off the drive motor. Spring *5* returns the bar to its initial position.

4444	ELECTRIC ELEVATOR CAGE DOOR SAFETY DEVICE MECHANISM	SmE FD

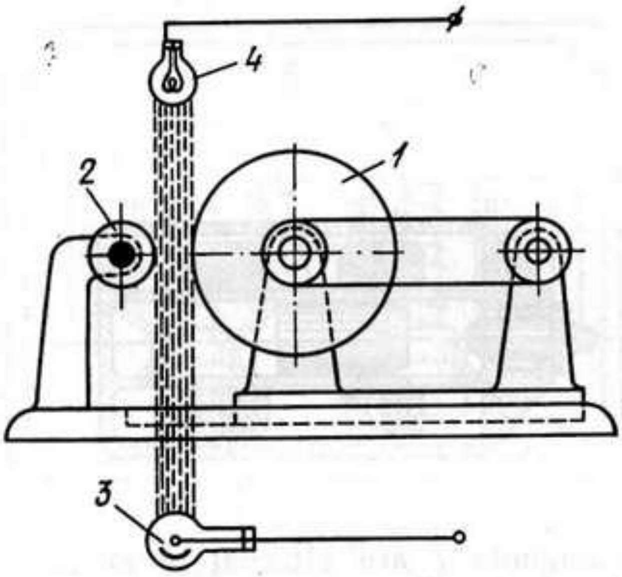


The elevator (lift) cage can begin travelling only if all the doors of the elevator shaft are closed and, with a passenger, if the cage door is also closed. Safety interlocking is accomplished by door contacts mounted on the cage above the door in a vertical position so that each wing of the door presses one of pins *1*, pushing it upward when the wing is closed. As each pin *1* moves upward, it compresses its spring *3*. Ebonite sleeve *2*, fitted on pin *1*, carries copper ring *a*. When the door wings are fully closed, pins *1* are pushed upward a distance sufficient to force rings *a* between contacts *4*, closing the elevator travel circuit. When the door wings are opened, springs *3* push pins *1* downward so that rings *a* open contacts *4*.



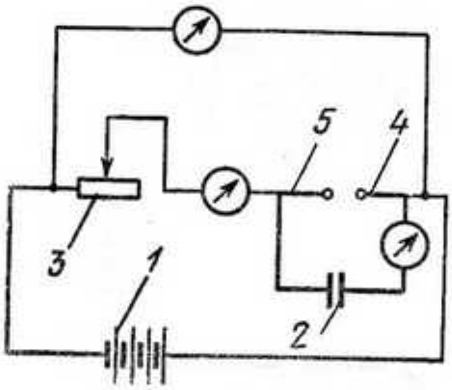
When electromagnets *1* are alternately energized, striker *2* (the core of the electromagnets) reciprocates because it is alternately attracted by the two electromagnets. D-c electric hammers have a switching device operated by the striker and the number of blows per minute is regulated by varying the voltage. A-c hammers have a constant number of blows per minute, determined by the frequency of the power supply.

4446	PHOTOELECTRIC CONRTOL MECHANISM FOR SWITCHING OVER FROM RAPID TOOL APPROACH TO WORKING FEED	SmE FD



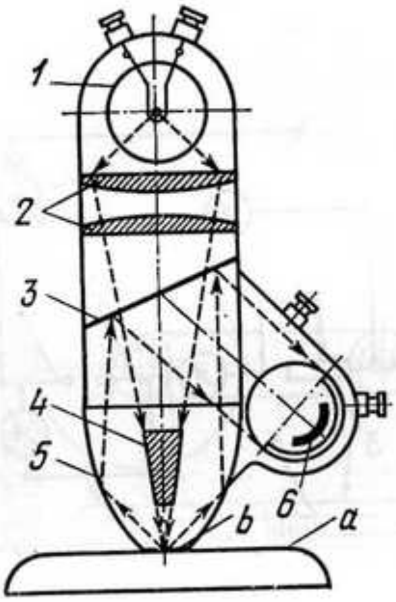
The illuminating of phototube *3* by light source *4* is reduced with the distance between cutting tool *1* (evidently a grinding wheel in this case) and workpiece *2*. At a definite value of the illumination of phototube *3* (a certain distance before the tool reaches the workpiece), a photoelectric relay is tripped, which disengages rapid approach of the tool and engages the working feed.

4447	ELECTRIC-(SPARK-)DISCHARGE MACHINING MECHANISM FOR METALS	SmE FD



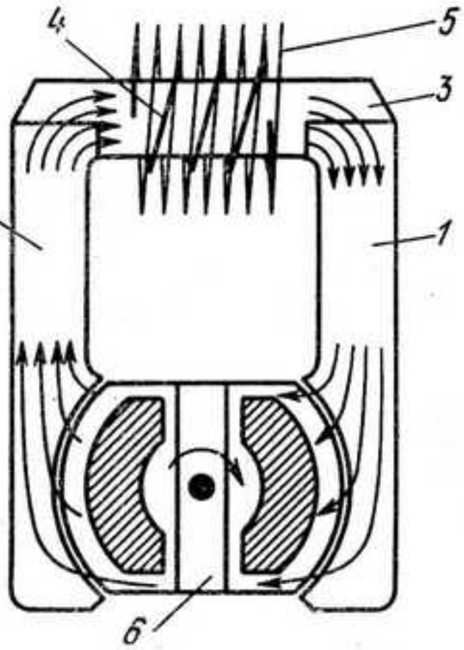
From d-c source *1*, capacitor bank *2* is charged through ballast resistor *3* to a voltage close to that of supply source *1*. This leads to a rupture of the gap between electrode *4* (the tool) and workpiece *5*. A spark discharge is initiated, capacitors *2* are discharged and the cycle is repeated again from the beginning. Since the process is carried out in a liquid dielectric medium, the circuit operates at high frequency because the medium is rapidly de-ionized.

4448	PHOTOELECTRIC TRACER MECHANISM FOR AUTOMATIC COPY MACHINING	SmE FD



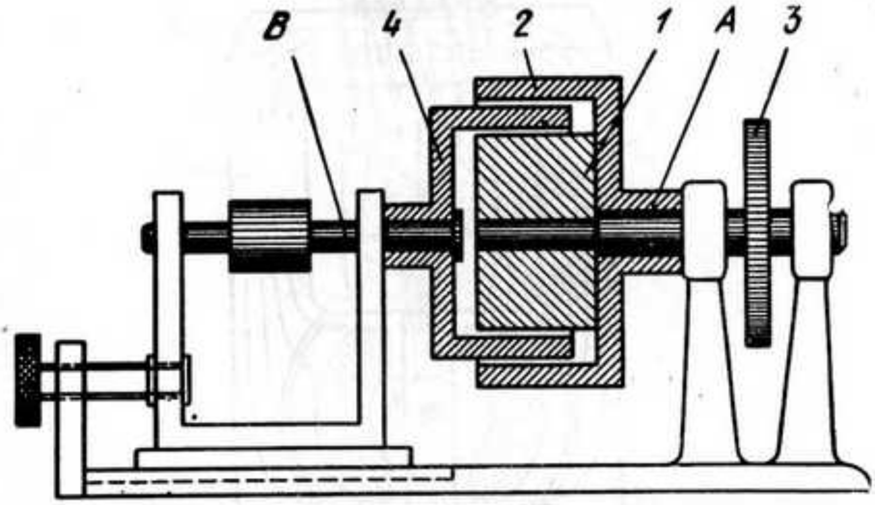
By means of condensor lenses 2 and microscope objective 4, light rays from light source 1 are collected into a "point" of light. Parabolic mirror 5 collects the light rays reflected from drawing *a* (the focal point of the mirror coincides with the point of light). Mirror 3 directs the light rays to phototube 6. Hole *b* in the centre of mirror 5 passes the light beam onto drawing *a*. The scattered pencil of light rays reflected from drawing *a* is directed onto phototube 6. Any change in the position of the point of light with respect to the outline of the drawing, i.e. its approach or retraction from the outline, changes the illumination of phototube 6 and, consequently, its current. By means of an amplifier, the current of phototube 6 controls the mechanisms of the machine tool, engaging and disengaging the rotation of the longitudinal and transverse lead screws as required, so that the cutting tool follows the outline of the drawing and contour-machines the workpiece.

4449	FIXED-WINDING MAGNETO MECHANISM	SmE FD



Two pole shoes, *1* and *2*, elongated to form plates, are connected together by core *3*, which has two windings: primary *4* and secondary *5*. When horseshoe magnet *6* is rotated, magnetic lines of force alternately appear and disappear in core *3*. This periodically induces a current of alternating direction in primary winding *4*. As the current is induced and disappears in primary winding *4*, high-tension current is induced in secondary winding *5*.

4450	INDUCTANCE SPEED EQUALIZER MECHANISM	SmE FD

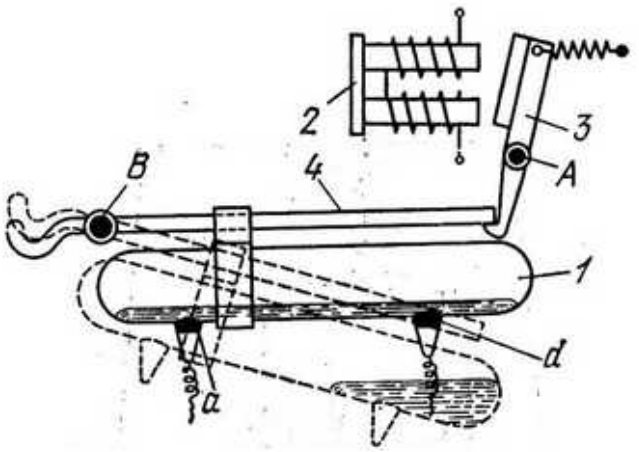


Magnet *1* and iron cylinder *2*, rigidly mounted on shaft *A*, are driven by gear *3*. The rotating magnetic field induces currents in copper sleeve *4* that set the sleeve and shaft *B* in rotation. The absence of a rigid linkage between the driving and driven shafts provides for the equalization of the speed of driven shaft *B*.

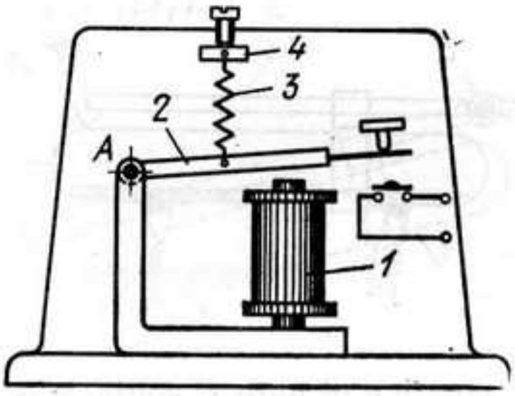
SECTION THIRTY-FOUR
Lever-Type Electric Mechanisms
LE

1. RELAY MECHANISMS (4451 through 4478)

4451	LEVER-TYPE MERCURY-CONTACT ELECTROMAGNETIC RELAY MECHANISM	LE Re

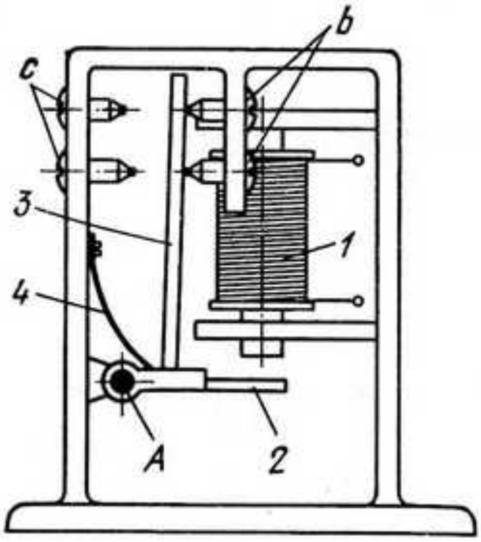


In the horizontal position of bulb *1*, contacts *a* and *d* are closed by the mercury. When electromagnet *2* is energized, armature *3*, turning about fixed axis *A*, is attracted to the electromagnet and releases lever *4*, turning about fixed axis *B*. Bulb *1*, mounted on lever *4*, is tipped downward by gravity, and contacts *a* and *d* are opened.



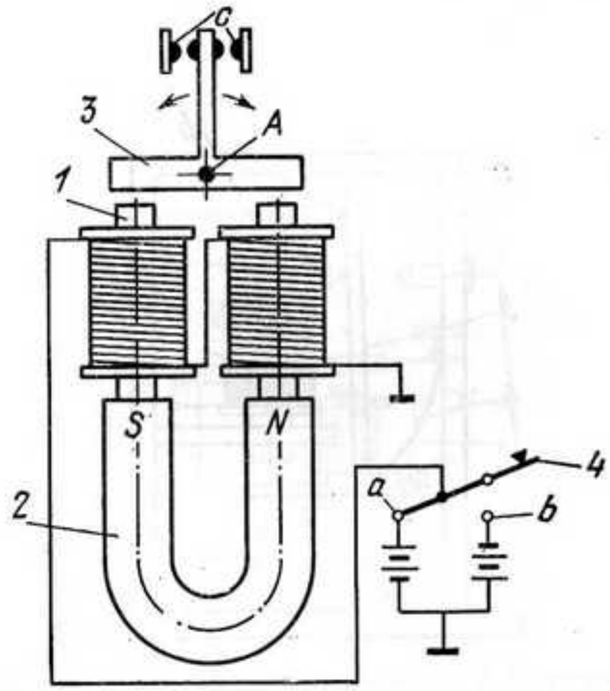
When the coil winding of electromagnet *1* is energized and de-energized, armature *2*, turning about fixed axis *A*, is attracted and then released and retracted by spring *3* whose tension is adjusted by screw *4*. Armature *2* closes and opens the contacts of the receiver.

LEVER-TYPE RELAY MECHANISM

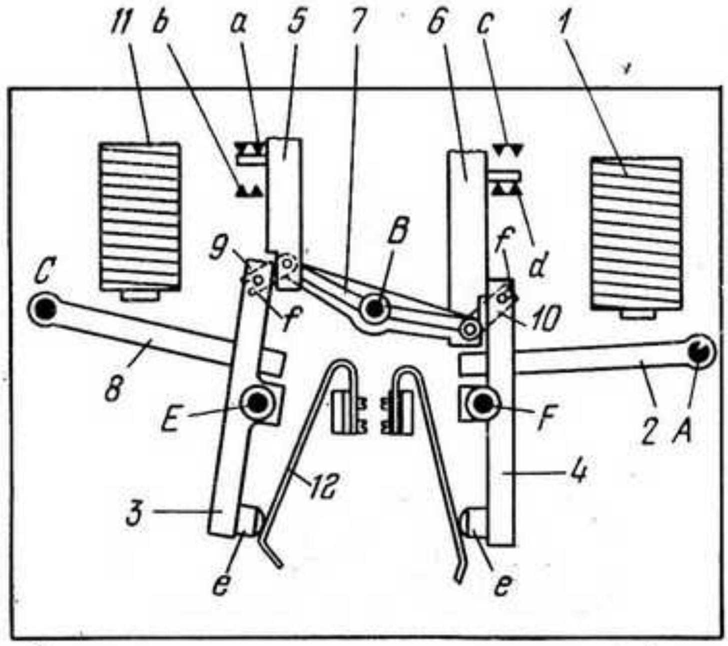


When the winding of electromagnet *1* is energized, armature *2*, turning about fixed axis *A*, is attracted to the electromagnet and, by means of strip *3*, opens the circuit connected to contacts *b* and closes the circuit connected to contacts *c*. When the coil of electromagnet *1* is de-energized, armature *2* is retracted by spring *4* to its initial position, turning strip *3* so that it closes the circuit of contacts *b* and opens the circuit of contacts *c*.

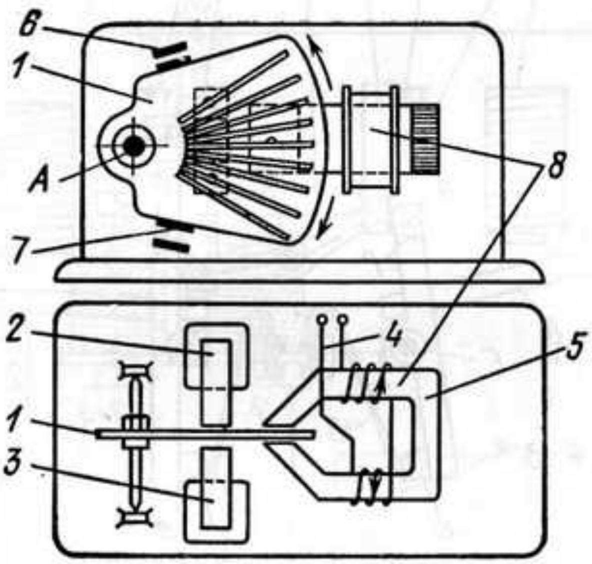
LEVER-TYPE POLARIZED RELAY MECHANISM



Cores *1* of the relay contact permanent horseshoe magnet *2*. When the electromagnet winding is de-energized, armature *3*, turning about fixed axis *A*, is in the horizontal position. Connected to contacts *a* and *b* of key *4* are two batteries of opposite sign. When the key closes one of the contacts, the current in the electromagnet winding has the corresponding direction, producing additional magnetic polarity in cores *1*. This additional polarity, due to the current, interacts with the magnetic polarities developed by permanent magnet *2*. A combination of like polarities increases the force of attraction of a core, and unlike polarities weaken this force. Armature *3* is attracted to the core having the greater force of attraction at any given time, closing the corresponding contacts at *c*.

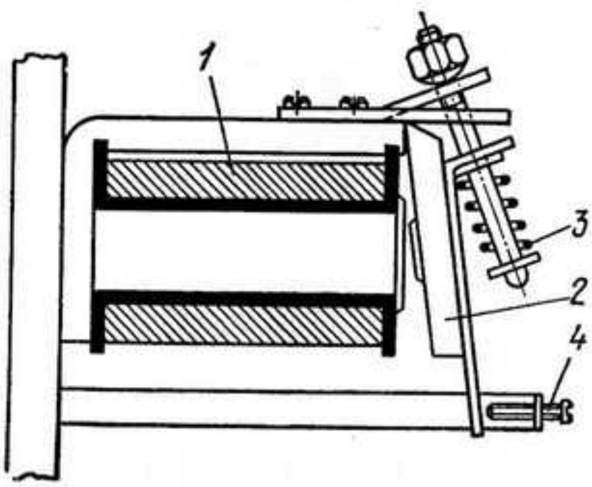


Armatures *2* and *8* turn about fixed axes *A* and *C*. Double-arm lever *7* turns about fixed axis *B*. Its intermediate links, *9* and *10*, have slots *f* which are connected by sliding pairs to pins of levers *3* and *4*, which turn about fixed axes *E* and *F*. When the winding of electromagnet *1* is energized, armature *2* is attracted and, in turning, engages the right-hand arm of lever *7*, turning it counterclockwise. This turns lever *3* counterclockwise, releasing bar *5*, which drops by gravity, opening contacts *a* and closing contacts *b*. At the same time, armature *2* raises bar *6*, opening contacts *d* and closing contacts *c*. At this, bar *6* is interlocked in its upper position by lever *4*. At the same time, contacts *d* break the supply circuit of the winding of electromagnet *1*. Similar opening and closing of contacts is accomplished by means of electromagnet *11*. Links *3* and *5*, and links *4* and *6* are held in engagement by springs *12*, which bear against bosses *e* of levers *3* and *4*.

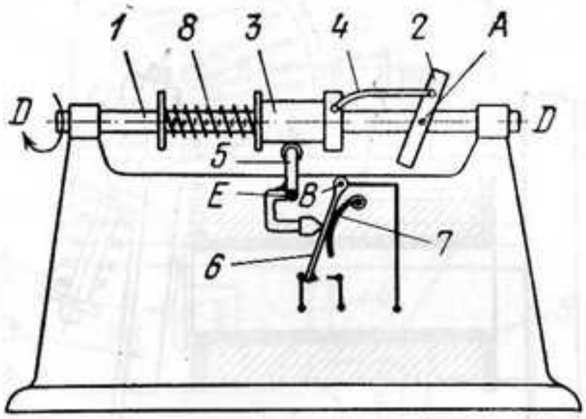


Coils *2* and *3* are arranged on the two sides of segment *1*, which turns about fixed axis *A* and has a part passing through the air gap of core *5*. Core *5* has winding *4* consisting of two coils *8*. When the windings of coils *2* and *3*, and winding *4* are energized, the alternating magnetic flux produced by coils *2* and *3* induces eddy currents in segment *1*. Winding *4* of coils *8* produces its own magnetic flux, which interacts with the eddy currents in segment *1*, turning the segment so that it closes one of the pairs of contacts, *6* or *7*, opening the other pair.

LEVER-TYPE TIME RELAY MECHANISM

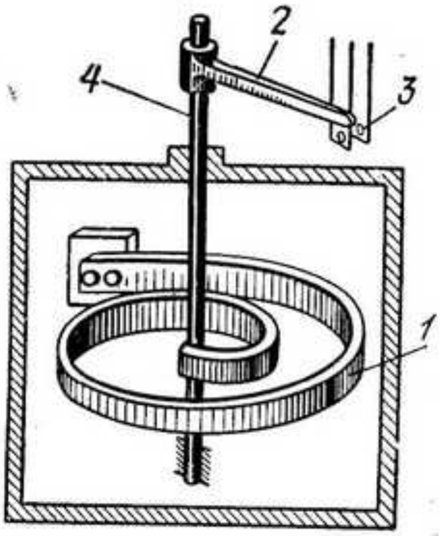


When coil *1* is energized, armature *2* is instantly attracted, compressing spring *3*. When coil *1* is shunted, the current decay is slowed down by self-induction in the coil circuit. Armature *2* of the relay is held in the closed position until the decaying flux in the magnetic system drops to a definite value at which spring *3* retracts armature *2* from electromagnet *1*. Stop *4* limits the return motion of armature *2*.



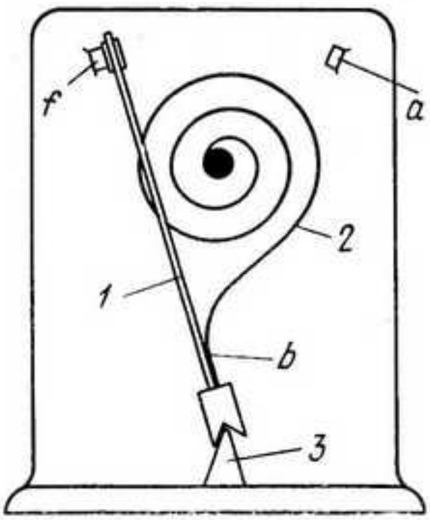
When shaft *1* rotates about fixed axis *D-D*, ring *2* is turned counterclockwise about axis *A*, pushing sleeve *3*, by means of intermediate link *4*, to the left. At a definite speed of shaft *1*, sleeve *3*, engaging two-arm lever *5*, turns it counterclockwise about fixed axis *E*. In turning, lever *5* turns switch member *6* about fixed axis *B*, overcoming the resistance of spring *7*. This switches over the contacts. The relay is adjusted to trip at a definite speed of shaft *1* by regulating spring *8*.

4459	BIMETALLIC-SPIRAL PROTECTIVE RELAY MECHANISM	LE Re



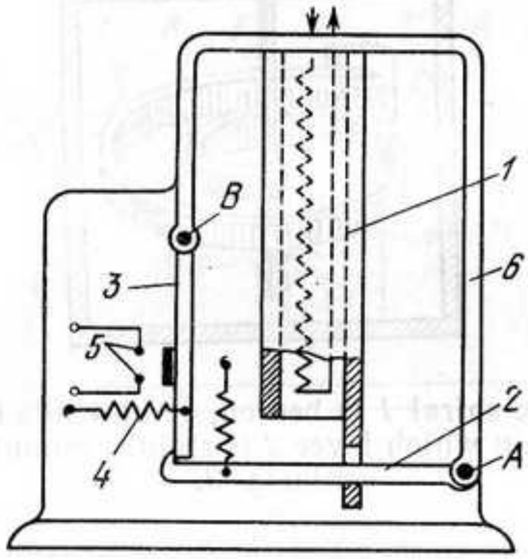
When bimetallic spiral *1* is heated, it unwinds to some extent, turning shaft *4* on which lever *2* is rigidly mounted. This closes contacts *3*.

4460	LEVER-TYPE THERMAL RELAY MECHANISM	LE Re



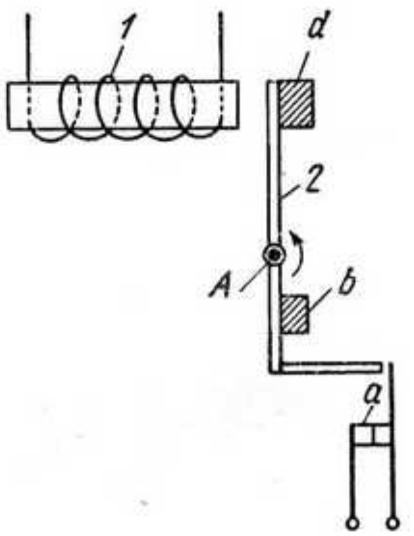
At low temperature, contact lever *1* closes the contacts at *f*. As the ambient temperature is raised, bimetallic spiral *2* is severely deformed and its movable end *b*, linked to lever *1*, flips over the lever, closing the contacts at *a*. Knife-edge *3* provides a snap action in switching over lever *1*.

4461	LEVER-TYPE THERMAL RELAY MECHANISM	LE Re



Enclosed in tube *1*, made of metal with a high coefficient of linear expansion, is a heating element with a certain current. At a definite temperature, the free end of tube *1* turns lever *2* counterclockwise about fixed axis *A*. This releases contact lever *3*, which is turned clockwise about fixed axis *B* by spring *4*, closing contacts *5*. When tube *1* is cooled, lever *3* can be returned to its initial position. Housing *6* is made of metal with a low coefficient of linear expansion.

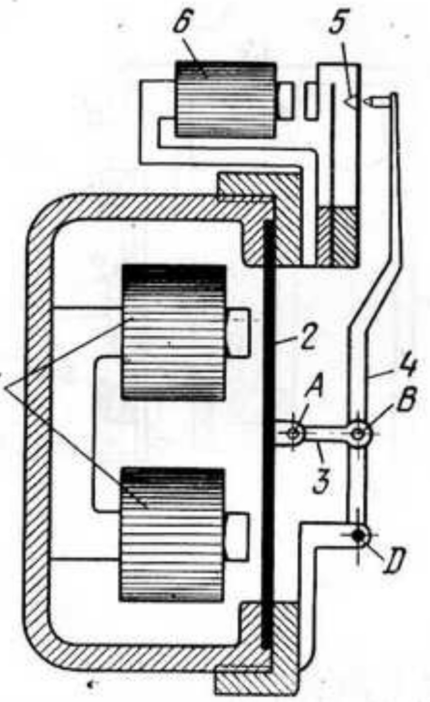
4462	LEVER-TYPE ELECTROMAGNETIC TIME RELAY MECHANISM	LE Re



When the winding of electromagnet *1* is energized, lever *2*, turning about fixed axis *A*, is attracted to the core of the electromagnet. Turning counterclockwise, lever *2* opens contacts *a*.

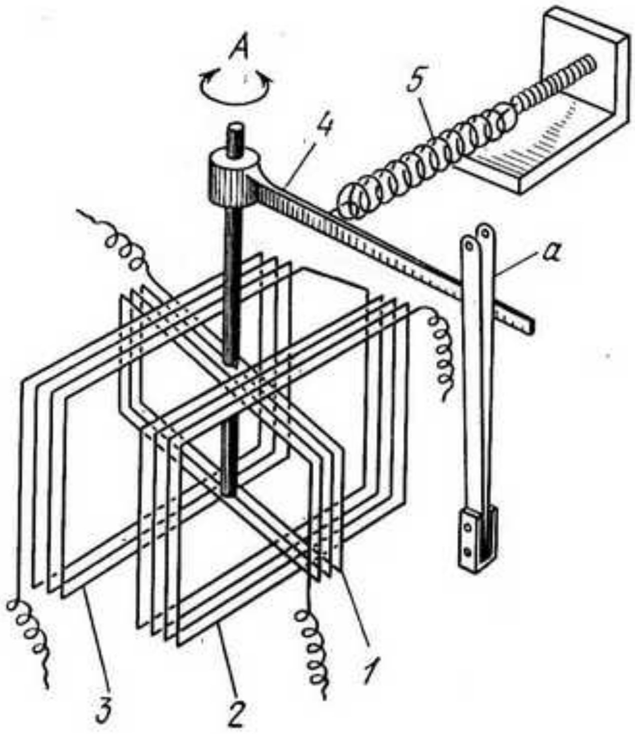
The time delay is due to the inertia of weights *d* and *b*.

LEVER-TYPE ELECTROMAGNETIC MEMBRANE RELAY MECHANISM



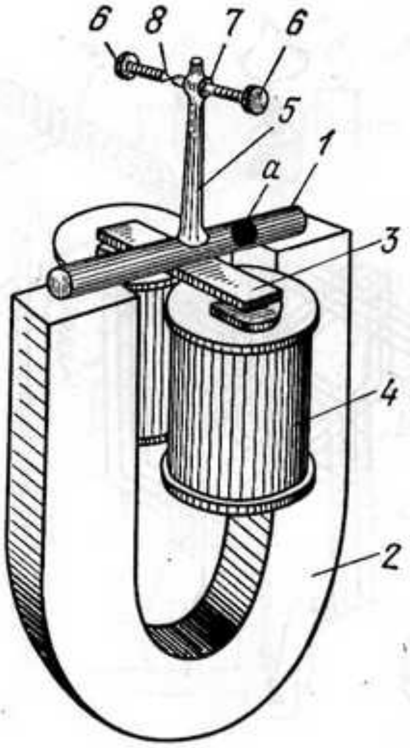
When the winding of electromagnet *1* is energized, steel membrane *2* is attracted to the core of the electromagnet and bends to the left. Link *3*, connected by turning pairs *A* and *B* to membrane *2* and lever *4*, turns lever *4* counterclockwise about fixed axis *D*, closing the contacts at *5*. These contacts have an interlocking feature provided by electromagnet *6* which holds them in the closed position after de-energizing the winding of electromagnet *1*.

4464	LEVER-TYPE ELECTRODYNAMIC RELAY MECHANISM	LE Re



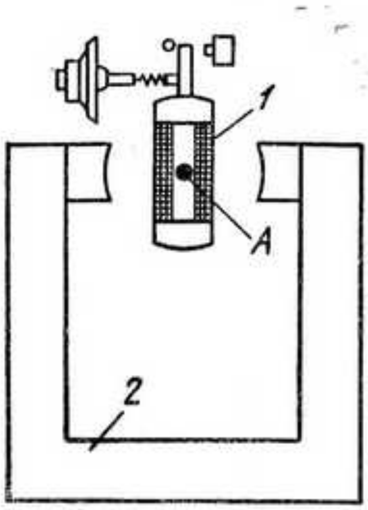
When the windings of coils *1*, *2* and *3* are energized, moving coil *1*, owing to the interaction of the magnetic fields set up by the coils, turns about fixed axis *A* and, by means of lever *4*, closes contacts *a*. Coils *2* and *3* are fixed. Spring *5* returns coil *1* to its initial position.

4465	LEVER-TYPE ELECTROMAGNETIC POLARIZED RELAY MECHANISM	LE Re



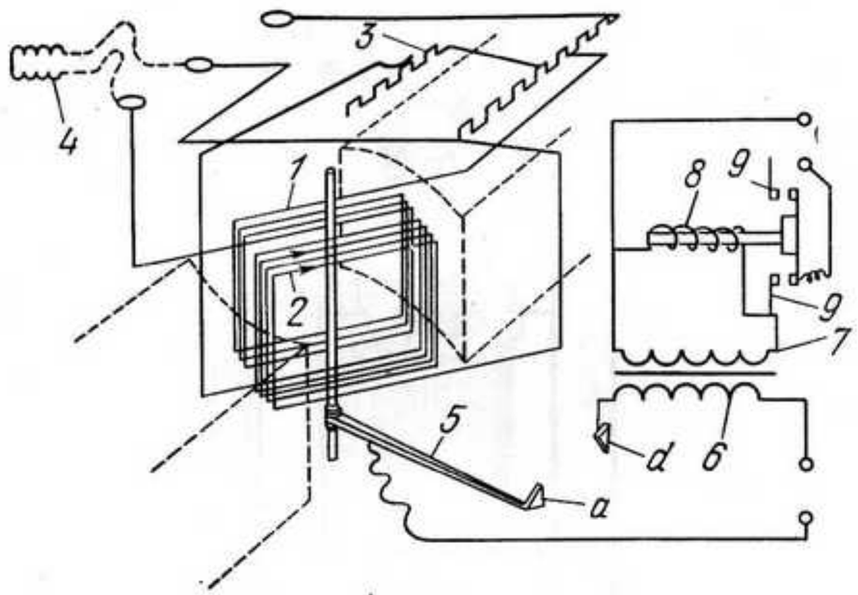
Armature *1*, lying on the poles of magnet *2*, carries plate *3*. Owing to copper insert *a* of armature *1*, plate *3* acquires north-seeking polarity. When the coils of electromagnet *1* are energized by current in one or the other direction, plate *3* is turned about a horizontal axis to the right or left, switching over lever *5* to the corresponding contact, *8* or 7. Adjustment is accomplished by screws *6*.

4466	LEVER-TYPE MAGNETOELECTRIC (MOVING-COIL) RELAY MECHANISM	LE Re



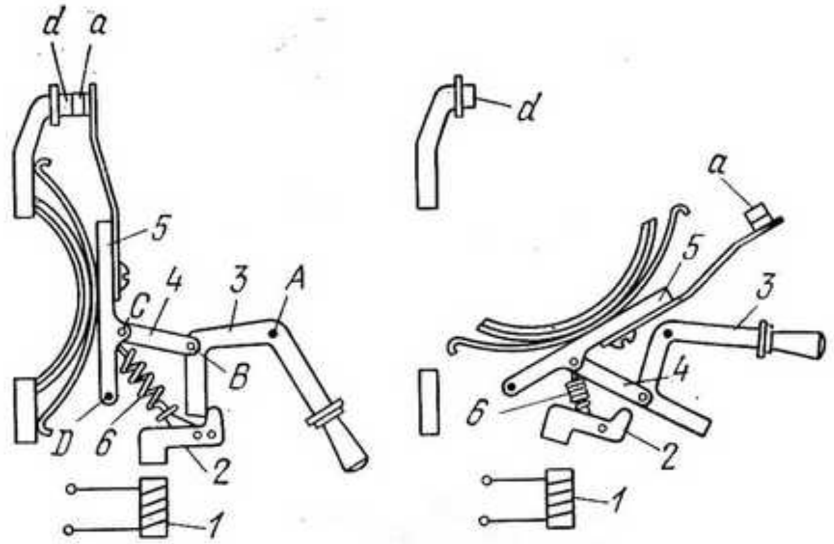
Coil *1* turns about fixed axis *A* in the field of permanent magnet *2*. When the winding of coil *1* is energized, the interaction of the electric field it sets up with the field of magnet *2* turns coil *1*, closing contacts of a circuit.

4467	LEVER-TYPE THERMAL PROTECTIVE RELAY MECHANISM WITH A MAGNETOELECTRIC (MOVING-COIL) DEVICE	LE Re



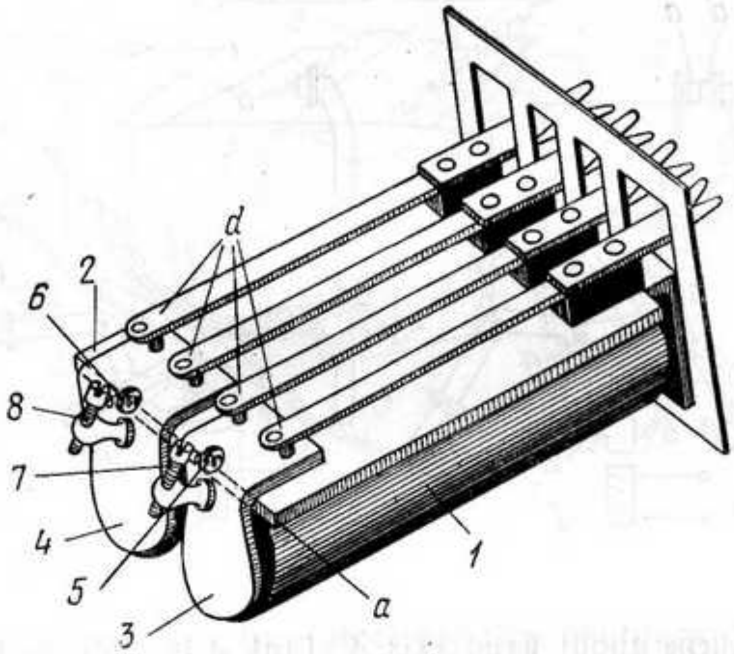
The relay is employed to protect exciting windings of generators and their terminals. It has two windings, *1* and *2*, connected differentially. The currents in the two windings are equal and opposite in direction at normal operating temperature. Adjustments are made with rheostat *3*, having a zero temperature resistance coefficient, connected to winding *2*. Connected to winding *1* is sensitive coil *4*, having a high temperature resistance coefficient. Sensitive coil *4* is arranged together with the turns of the windings that are to be protected in the electromagnetic system (for example, an electric motor). As its resistance increases upon being heated, sensitive coil *4* disturbs the equality of currents in the magnetoelectric device, deflecting the coils, which are linked to indicating hand *5*. At a definite angle of deflection of the coils, lug *a* of hand *5* engages lug *d*, initiating a spark. The instantaneous current of secondary winding *7* of transformer *6*, trips self-locking relay *8*, which closes the working contacts *9*.

LINKWORK-TYPE ELECTROMAGNETIC RELAY MECHANISM



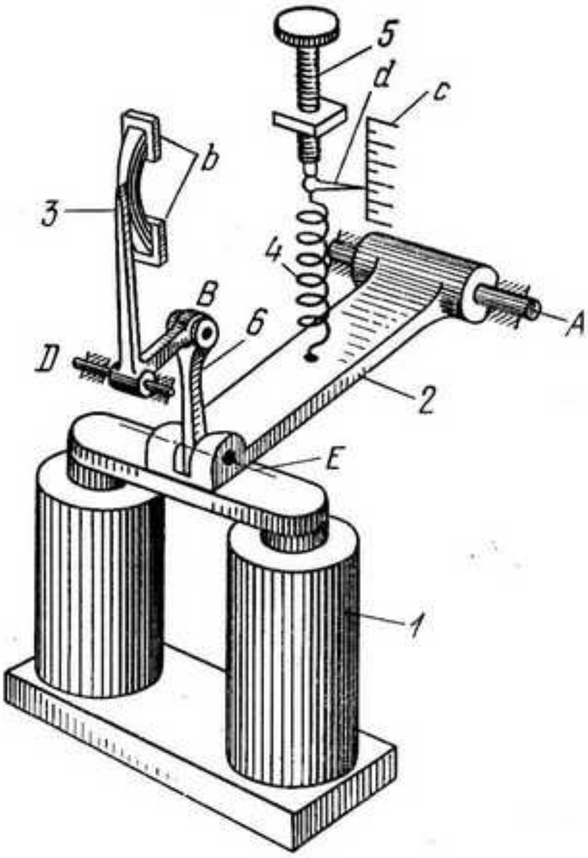
Lever 3 turns about fixed axis A. Link 4 is connected by turning pairs B and C to lever 5, which turns about fixed axis D. When the coil of electromagnet 1 is energized, armature 2 is attracted to the core of this electromagnet and holds four-bar linkwork mechanism $ABCD$ in the position in which contacts a and d are closed. When the coil of electromagnet 1 is de-energized, armature 2, no longer held by the electromagnet, releases lever 3. At this, lever 5, actuated by spring 6, opens contacts a and d.

4469	LEVER-TYPE DOUBLE ELECTROMAGNETIC RELAY MECHANISM WITH A DISK ARMATURE	LE Re



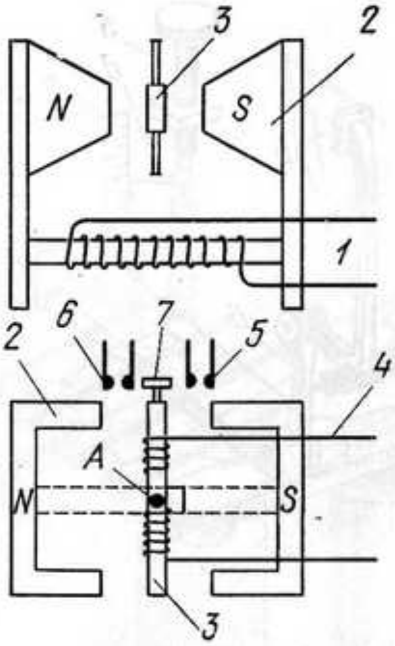
When the windings of electromagnets *1* and *2* are energized, disk armatures *3* and *4* are attracted to the electromagnet cores and turn about corner *a*, closing contacts *d*. Armatures *3* and *4* are returned to their nonoperative position by springs *5* and *6*, which are adjusted by screws *7* and *8*.

4470	LEVER-TYPE ELECTROMAGNETIC PROTECTIVE RELAY MECHANISM	LE Re



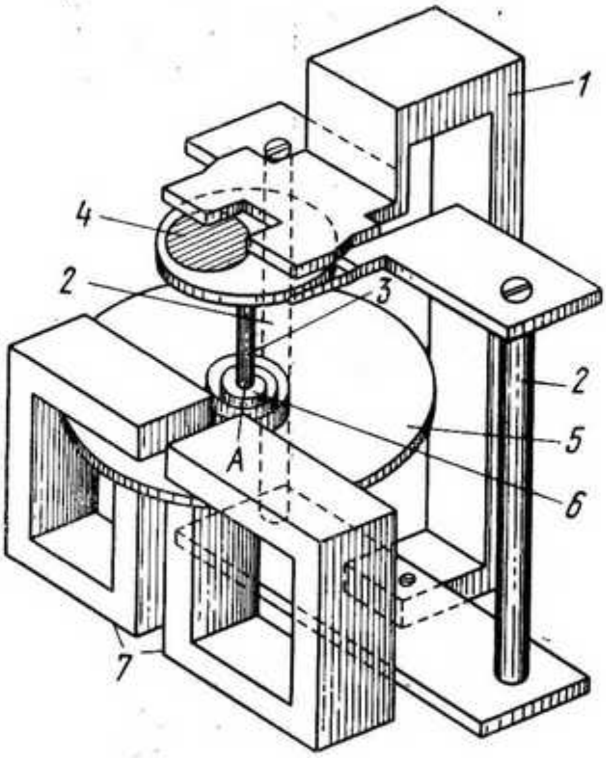
Armature 2 turns about fixed axis A. Lever 6 is connected by turning pair E to armature 2 and by turning pair B to bell-crank contact lever 3, which turns about fixed axis D. Under normal working conditions, electromagnet 1 holds armature 2 in the attracted position, so that lever 3 closes the contacts at b. When the energizing of electromagnet 1 drops to a certain definite value, spring 4 retracts armature 2 and the contacts at b are opened. The relay is adjusted by regulating the tension of spring 4 with screw 5. Screw 5 has indicator d moving along scale c and enabling the relay to be set to the required tripping current.

LEVER-TYPE D-C DIRECTIONAL RELAY MECHANISM



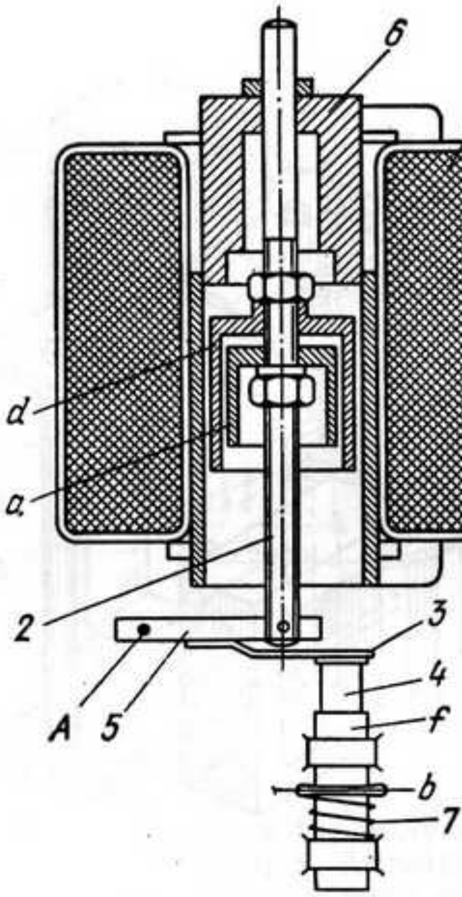
The winding of coil *1* magnetizes the relay in a definite direction as shown by the letters N and S. Armature *3*, turning about central fixed axis *A*, is arranged between pole shoes *2*, which form the upper part of the frame, and is magnetized by second coil *4*. The motion of armature *3* depends upon the strength and direction of its own magnetic field with respect to the strength and direction of the magnetic field set up by pole shoes *2*, i.e. the motion of armature *3* depends upon the ratio of the currents and their directions in coils *1* and *4*. Two pairs of spring contacts, *5* and *6*, are arranged on the two sides of armature *3*. The contacts are closed by insulated roller *7*, mounted on the end of the armature. Each pair of contacts opens by spring action when released.

4472	LEVER-TYPE ELECTROMAGNETIC POLARIZED TIME RELAY MECHANISM	LE Re



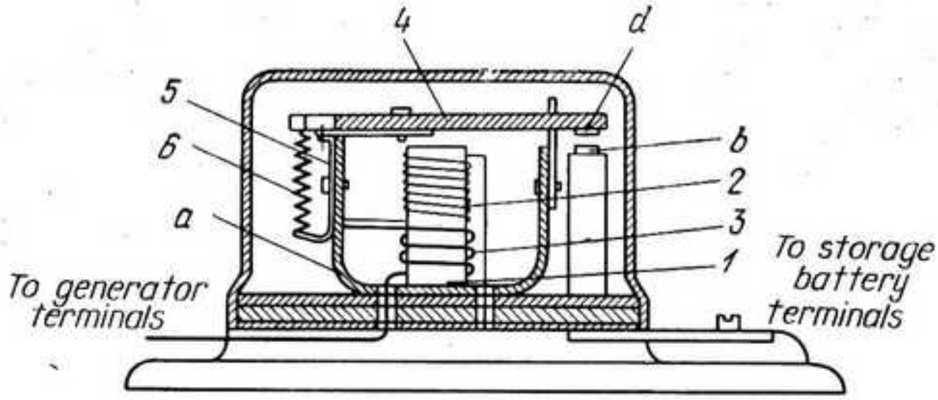
Arranged in the gap between permanent magnet 1 and the core of horseshoe electromagnet 2 is disk armature 4, eccentrically mounted on shaft 3. As armature 4 turns about fixed axis A, it closes contacts. Armature 4, together with shaft 3 and aluminium damping disk 5, is turned to its nonoperative position by spiral spring 6. When there is no current in the coils (not shown) of electromagnet 2, the flux from permanent magnet 1 is divided equally between the two branches of the core of electromagnet 2. The shape and position of armature 4 are selected so that the resultant torque acting on it from the two fluxes equals zero. When there is current in the windings, the two fluxes are no longer equal. The torque developed counteracts spring 6, which can be selected so that armature 4 begins to turn only at a definite torque value. The relay is set to the required time delay by selecting the shape and thickness of armature disk 4, the elasticity of spring 6 and the proper position of braking magnets 7.

LEVER-TYPE A-C RELAY MECHANISM



When the coil of electromagnet *1* is energized, its armature, consisting of two cylinders, *a* and *d*, screwed on rod *2*, is pulled into the coil of electromagnet *1* and relay contacts *3* and *4* are opened. When the coil of the electromagnet is de-energized, contacts *3* and *4* are closed by the weight of the armature and by spring *7*. Contact *3* is a strip mounted rigidly on lever *5*, which turns about fixed axis *A* and is connected by a turning pair to rod *2*. Contact *4* is a carbon rod mounted in copper holder *f* to which yoke *b* is attached. The lead to the contact is clamped by yoke *b*. Inserted above in the coil of electromagnet *1* is iron cylinder *6*, mounted rigidly on the body of the relay. Rod *2* of the armature passes freely through cylinder *6*. Cylinder *6* can be adjusted vertically by means of bolts to vary the magnetic flux and thereby regulate the current at which contacts *3* and *4* are closed.

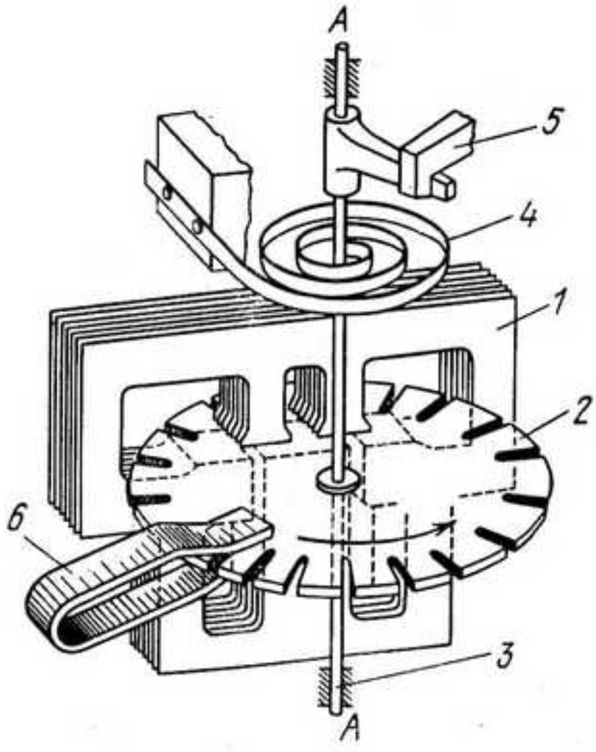
LEVER-TYPE REVERSE-CURRENT RELAY MECHANISM FOR AN AUTOMOBILE GENERATOR



The reverse-current relay is intended for closing the generator-battery circuit when the generator voltage exceeds that of the storage battery, and for breaking this circuit when the generator voltage is less than that of the battery. The relay consists of core *1*, having two windings: shunt winding *2* with a great number of turns of thin wire, and series winding *3* with a small number of turns of thick wire. The ends of these windings are connected to insulated post *a*. Mounted on post *a* by means of flexible flat spring (reed) *5* is armature *4*, at the other end of which contact *d* is attached. Movable contact *d* is just above fixed contact *b*. Spring *6* holds the contacts in the open position. When the generator is not in operation or is running at low speed, either no magnetic field is set up by shunt winding *2* and series winding *3*, or the field is too weak to magnetize core *1* sufficiently for it to overcome the resistance of spring *6*, at the given gap, and pull armature *4* downward. When the speed of the generator increases, the voltage over its terminals also increases. When this voltage somewhat exceeds that over the battery terminals, the magnetic field set up mainly by shunt winding *2*, having a large number of turns, becomes strong enough for the magnetized core *1* to overcome the resistance of spring *6*, attract armature *4* and close contacts *d* and *b*. This closes the generator-battery circuit and the generator current is supplied to the battery through series winding *3*. Windings *2* and *3* are wound on core *1* in such a way that when the current direction is from the generator to the battery, the magnetic fields of the windings add together, holding contacts *d* and *b* closed. When the speed of the generator drops and, with contacts *d* and *b* closed, the voltage at the generator terminals becomes less than

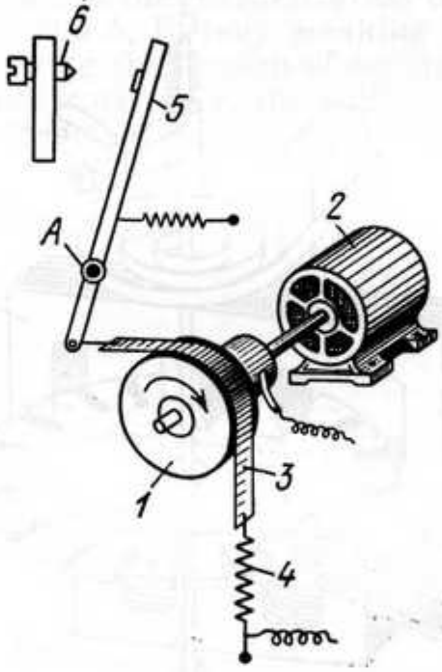
that of the battery, the current direction is from the battery to the generator, energizing series winding *3* in the reverse direction. The current direction in shunt winding *2* remains unchanged. Since the direction of the current in series winding *3* is reversed, the field of this winding counteracts that of shunt winding *2*. This reduces the magnetization of core *1* and spring *6* opens contacts *d* and *b*, thereby breaking the battery-generator circuit. By varying the tension of spring *6* and the air gap between core *1* and armature *4*, the voltage at which the relay contacts close can be regulated.

4475	LEVER-TYPE INDUCTION TIME RELAY MECHANISM	LE Re



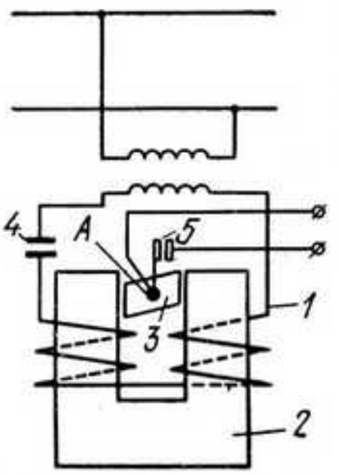
When the coil of electromagnet *1* is energized, aluminium disk *2*, mounted on shaft *3*, turns about fixed axis *A-A*, overcoming the resistance of spiral spring *4*. This closes the contacts at *5*. The time delay is provided by the rigidity of spring *4* and the braking effect of permanent magnet *6*.

4476	LEVER-TYPE FLEXIBLE-LINK ELECTROSTATIC RELAY MECHANISM	LE Re



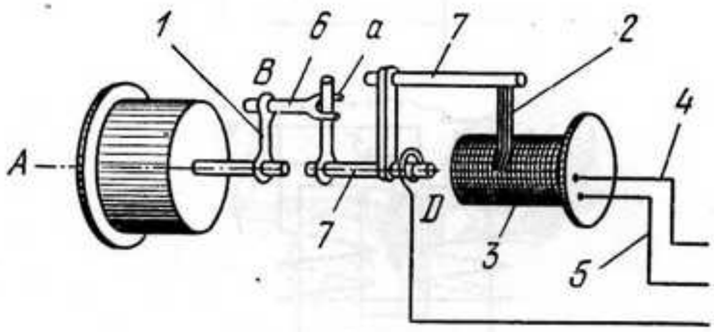
The relay consists of agate pulley *1*, which is rotated clockwise by electric motor *2* at constant speed. Running over pulley *1* is thin steel band *3* with one end attached through spring *4* to a fixed upright and the other end, to contact lever *5*, which turns about fixed axis *A*. When voltage is applied over pulley *1* and band *3*, the latter is attracted to the pulley and turns contact lever *5* counterclockwise, closing the contacts at *6*.

4477 **LEVER-TYPE TUNED RELAY MECHANISM** LE Re



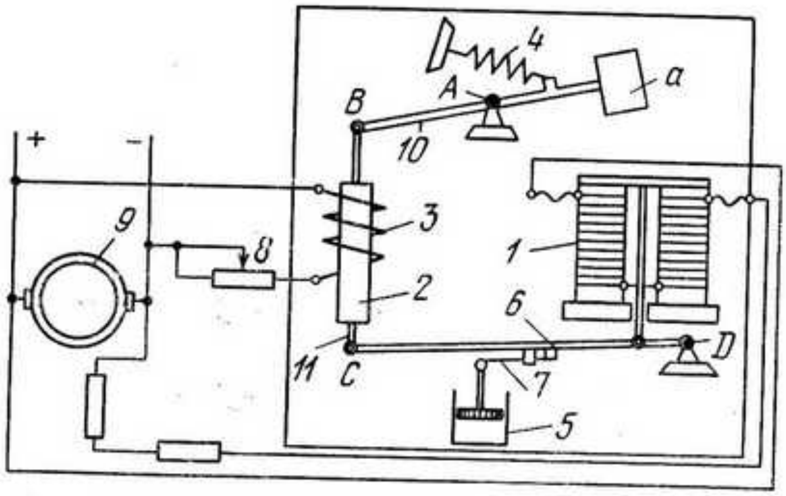
Exciting winding *1* of control relay *2* is tuned to a definite period of natural oscillations. Relay *2* has rotary balanced armature *3* and winding *1* is connected in series with capacitor *4*. At the instant of resonance of these oscillations with the disturbing oscillations of the circuit, armature *3* turns about fixed axis *A*, closing contacts at *5*.

LEVER-TYPE DRUM RHEOSTAT MECHANISM



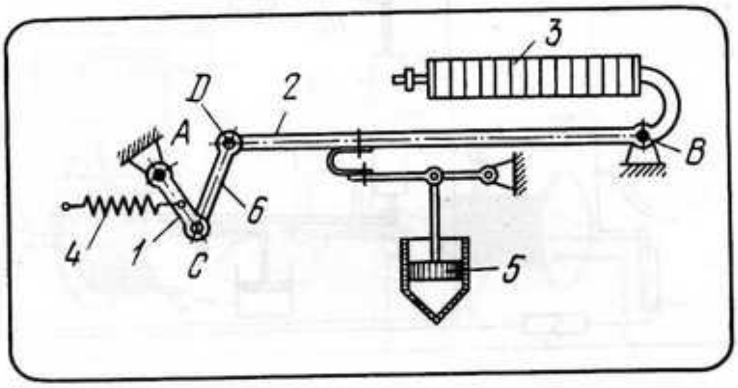
Lever *1* rotates about fixed axis *A* and is connected by turning pair *B* to link *6*. Fork *a*, at the other end of link *6*, engages lever *7*, rotating about fixed axis *D*. Brush *2* is rigidly mounted on lever *7*. When lever *1* turns, brush *2* slides along the resistance winding of stationary drum *3*, thereby varying the currents in lines *4* and *5*.

4479	LEVER-TYPE CARBON-PILE REGULATOR MECHANISM FOR A GENERATOR	LE Rg



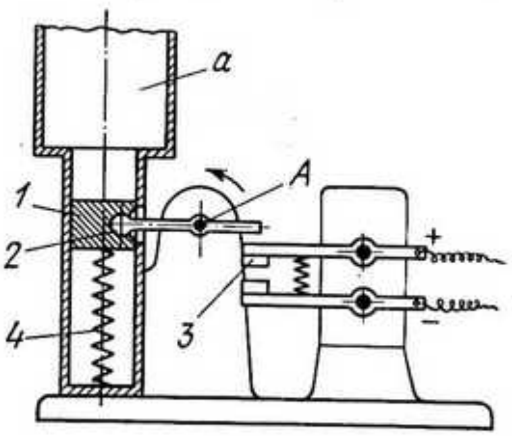
Lever *10* with counterbalancing weight *a* turns about fixed axis *A*. Link *11* with core *2* is connected by turning pairs *B* and *C* to lever *10* and to lever *6*, which turns about fixed axis *D*. Two forces act on carbon piles *1*. One is due to the pulling of core *2* into measuring coil *3*, and the second, to the tension of spring *4*. Spring *4* tends to compress the carbon wafers, and the pull of core *2* of coil *3* reduces the force exerted by spring *4*. The carbon piles are connected into the circuit of the field winding of generator *9*. Upon an increase in the output voltage of the generator, the current increases in measuring winding *3*. This raises core *2*, reducing the pressure on carbon piles *1* and increasing their resistance, thereby reducing the field current of the generator. Possible oscillations are damped by piston-type damper *5*, connected to lever *6* through flat spring *7*. The point at which the spring is attached to lever *6* is adjustable. Rheostat *8* serves to set the value of the voltage being regulated. When the output voltage of the generator drops, the pressure acting on the carbon piles increases, their resistance is reduced and the field current of the generator increases.

4480	LEVER-TYPE CARBON-PILE REGULATOR MECHANISM FOR A SYNCHRONOUS MOTOR	LE Rg



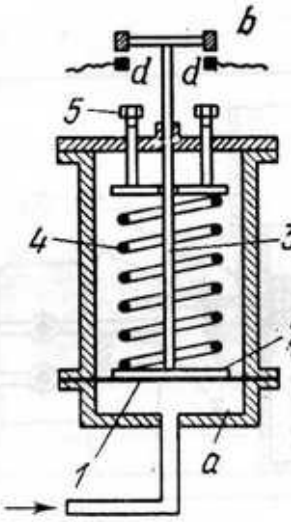
Lever 1 turns about fixed axis A. Link 6 is connected by turning pairs C and D to lever 1 and to lever 2, which turns about fixed axis B. Upon an increase in the load on the synchronous motor, lever 1, overcoming the resistance of regulator spring 4, begins to turn counterclockwise about axis A. This raises the end of lever 2, turning it clockwise about axis B and thereby reducing the pressure on carbon-pile rheostat 3. This increases the resistance of the rheostat and reduces the voltage of the generator and the speed of the motors it supplies. Piston-type damper 5 damps the oscillations of the mechanism.

4481 LEVER-TYPE PRESSURE REGULATOR MECHANISM LE Rg



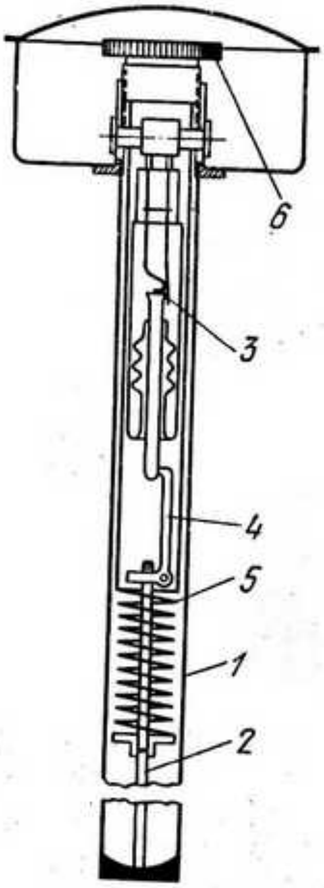
When the pressure in cylinder *a* increases, piston *1* moves downward, turning lever *2* counterclockwise about fixed axis *A*. This opens switch *3*, turning off the mechanism that delivers gas to cylinder *a*. When the pressure drops in cylinder *a*, spring *4* pushes piston *1* upward, turning lever *2* clockwise about axis *A* so that switch *3* closes the electric circuit.

4482	MEMBRANE-TYPE PRESSURE REGULATOR MECHANISM	LE Rg



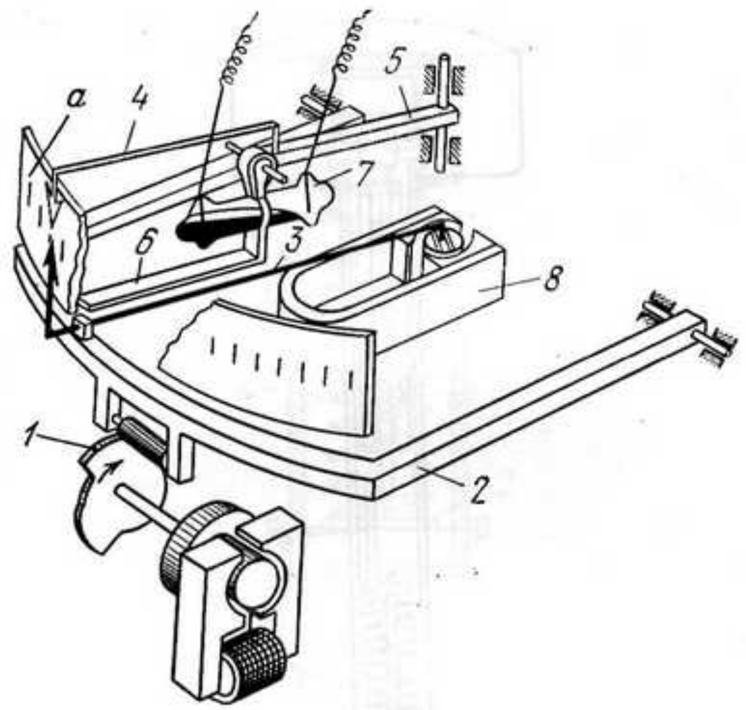
When the pressure drops in the vessel connected to chamber *a*, membrane *1* is bent downward. At this, disk *2* with rod *3* moves downward, closing the movable and fixed contacts *b* and *d*. This switches on a compressor (not shown) that delivers compressed air to the vessel connected to chamber *a*. When the pressure in the vessel increases above the permissible limit, membrane *1* is bent upward, overcoming the resistance of spring *4* and opening the contacts to switch off the compressor. The force exerted by spring *4* is regulated by screws *5*.

4483	ROD-TYPE TEMPERATURE REGULATOR MECHANISM	LE Rg



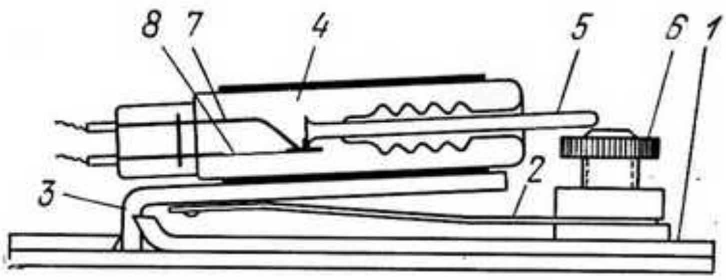
The principle of the rod-type regulator is based on the different changes in length of two bodies whose coefficients of linear expansion greatly differ. As the ambient temperature increases, shielding tube *1*, having a high coefficient of linear expansion, elongates, while the length of rod *2*, having a low coefficient of expansion and enclosed inside tube *1*, remains almost unchanged. As a result, rod *2* is shifted with respect to the cartridge enclosing vacuum switch *3*, actuating the contact of this switch through lever *4*. Spring *5*, arranged between rod *2* and the cartridge of vacuum switch *3*, holds the rod against the bottom of shielding tube *1* and the cartridge against regulating screw *6*, located in the output head. The required value of the temperature to be controlled is set by screw *6*.

4484	LEVER-CAM TEMPERATURE REGULATOR MECHANISM	LE Rg



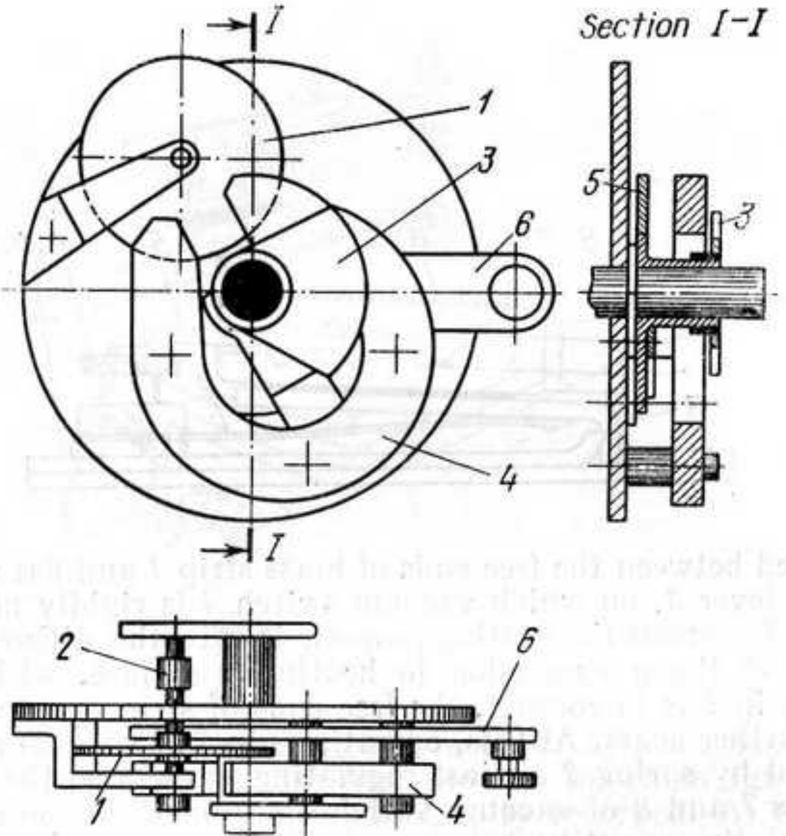
The temperature to be controlled is recorded by a magnetoelectric (moving-coil) instrument (not shown), in which the reading of its indicating hand is periodically recorded. As cam *1* rotates, bow member *2* is raised and lowered. In its upward motion, member *2* raises hand *3*, which moves along scale *a* by the action of the magnetoelectric measuring device. If hand *3* is at the preset value of the quantity being controlled, i.e. under setting hand *4*, then contacting rocker arm *5* of pressure strip *6* is in the horizontal position. At this, mercury switch *7* switches on the heating device. While bow member *2* rises, lever *3* turns to the new value of the quantity being measured and the process is repeated from the beginning. Thus, the regulator provides pulse contacts, switching on the devices that maintain the temperature at the preset value. The length and frequency of the pulses depend upon the interval between successive upward motions of bow member *2*. If the temperature being controlled exceeds the preset value, then when hand *3* is raised together with member *2*, it does not run against hand *4* and mercury switch *7* does not switch on the heating device.

4485	SURFACE TEMPERATURE REGULATOR MECHANISM	LE Rg



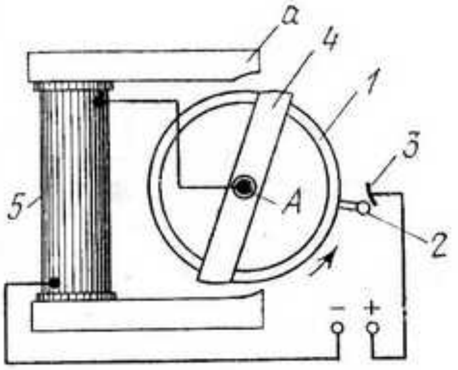
Arranged between the free ends of brass strip *1* and flat spring *2* is bent lever *3*, on which vacuum switch *4* is rigidly mounted. Switch *4* controls the heating process. Due to the different coefficients of linear expansion in heating a surface, with which brass strip *1* is in contact, the free ends of strip *1* and spring *2* move farther apart. At this, operating pin *5* of vacuum switch *4* is forced by spring *2* against regulating screw *6* so that spring contacts *7* and *8* of vacuum switch *4* are opened. The required value of the quantity being controlled can be set by means of setting screw *6*.

4486	DISK-TYPE INDUCTION SPEED REGULATOR MECHANISM	LE Rg



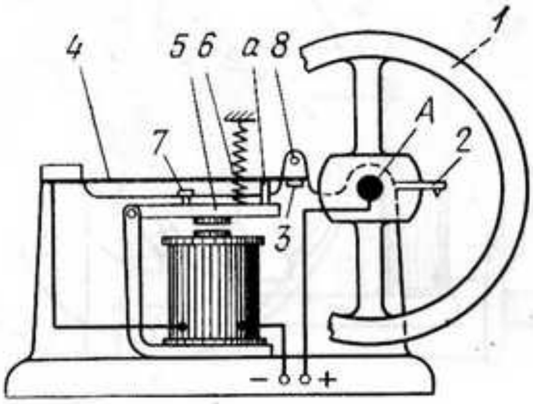
Disk *1* is driven through pinion *2* from an electric motor (not shown). In the position of magnetic shunt *3* shown, the magnetic flux of permanent magnet *4* is directed through disk *1* and segment *5*. At this, the braking effect of the induced eddy currents reaches its maximum value and disk *1* rotates at minimum speed. As lever *6* is turned counterclockwise, segment *5* moves out from under the poles and shunt *3* reduces the air gap between the poles of magnet *4*. This reduces the braking effect of the eddy currents, and the speed of rotation of disk *1* increases. When shunt *3* completely covers the poles of magnet *4*, the magnetic flux is through the shunt and the braking effect of the eddy currents is minimal. At this, the speed of disk *1* reaches its maximum value.

4487	LEVER-TYPE TRIPPING SPEED REGULATOR MECHANISM FOR AN ELECTRIC CLOCK ESCAPEMENT	LE Rg



When balance wheel *1* turns counterclockwise about fixed axis *A*, contact pin *2*, mounted rigidly on the balance wheel, slides along the inside of strip *3*, retracting it slightly to the right. This closes the electric circuit and armature *4* is attracted to pole shoes *a* of electromagnet *5*, transmitting an impulse to balance wheel *1*. When armature *4* reaches its vertical position, contact pin *2* slides off strip *3*, opening the circuit. In the reverse rotation of balance wheel *1*, due to the action of a spiral spring (not shown), contact pin *2* engages the outer, nonconducting side of strip *3* so that the circuit remains open.

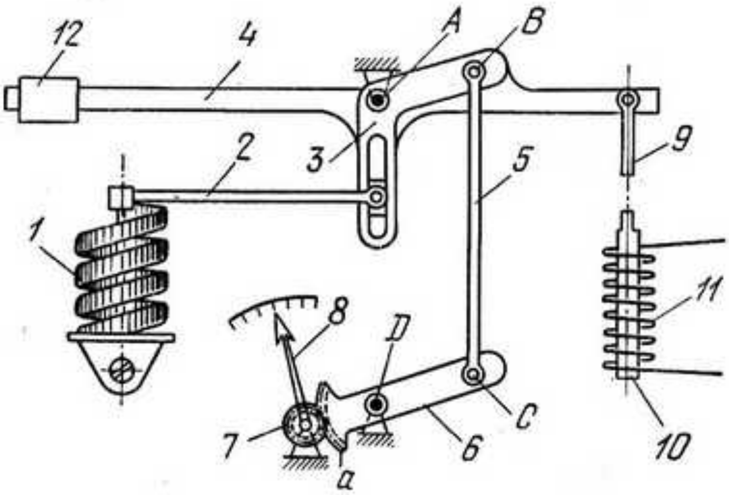
4488	LEVER-TYPE TRIPPING SPEED REGULATOR MECHANISM FOR AN ELECTRIC CLOCK ESCAPEMENT	LE Rg



When balance wheel *1* turns clockwise about fixed axis *A*, contact pin *2* runs up against contact *3*, mounted on flat spring *4*, and slightly raises the spring. This closes the electric circuit, armature *5* is tripped and it releases spring *4*. Through contact pin *2*, spring *4* transmits an impulse to balance wheel *1* in its return motion. When, in its downward motion, spring *4* reaches pin *a* of attracted armature *5*, the circuit is broken and the armature is moved upward by spring *6*, returning spring *4* to its initial position. Contact pin *2* raises spring *4* by an amount considerably less than it moves downward with spring *4*. This difference in the strokes of spring *4* is the source of the work done by the impulse in maintaining the oscillation of balance wheel *1*. Pin *8* limits the deformation of spring *4* upon an excessive amplitude of oscillation of balance wheel *1*. Screw *7* adjusts the travel of armature 5.

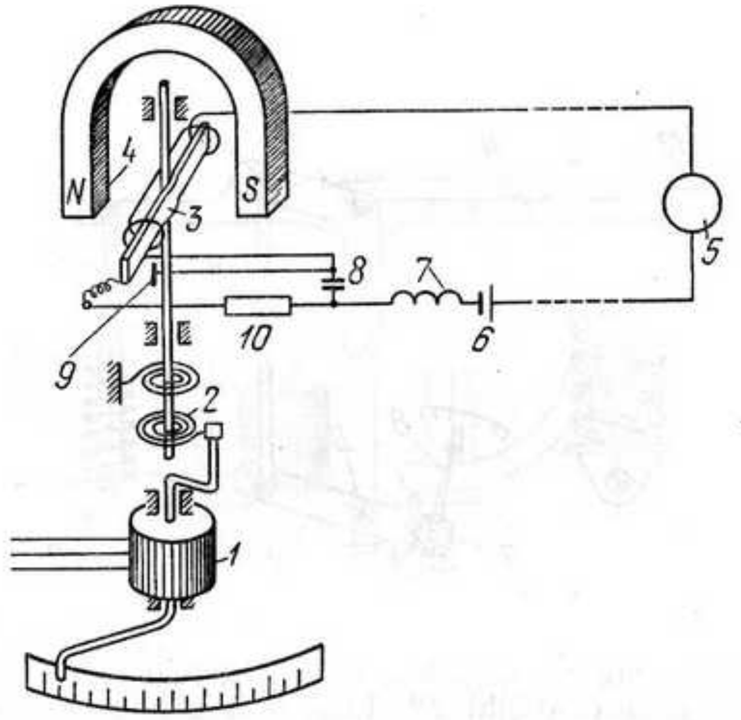
3. MECHANISMS OF MEASURING AND TESTING DEVICES (4489 through 4516)

4489	LEVER-TYPE INDUCTANCE PRESSURE GAUGE MECHANISM	LE M



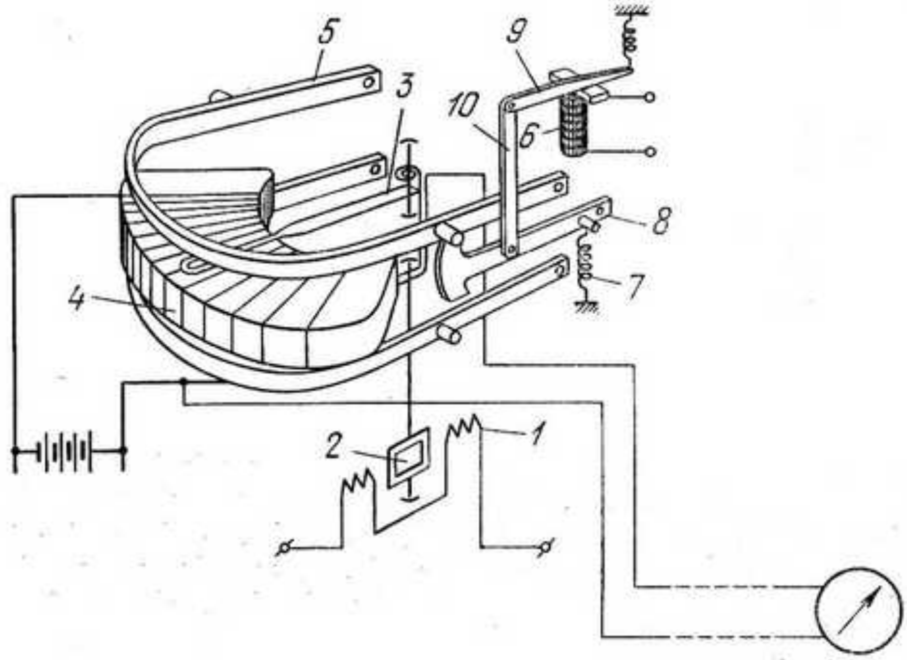
Rocker arm *3*, rigidly attached to link *4*, turns about fixed axis *A* and has counterweight *12*. Link *5* is connected by turning pairs *B* and *C* to rocker arm *3* and to lever *6*, which turns about fixed axis *D*. When the pressure varies inside hollow helicoid spring *1*, its free end actuates rocker arm *3* through link *2*. At this, link *5* turns segment gear *a* of lever *6*. Segment gear *a* meshes with pinion *7* on which hand *8* is rigidly mounted. The turning of rocker arm *3* and link *4* is accompanied by the motion of tie rod *9* and core *10*, arranged inside induction coil *11*. Displacement of the core leads to a change in the inductive impedance of the circuit of coil *11*. This is used for remote indication of the pressure being measured.

4490	LEVER-TYPE REMOTE-READING MECHANISM FOR MEASURED ELECTRICAL QUANTITIES	LE M



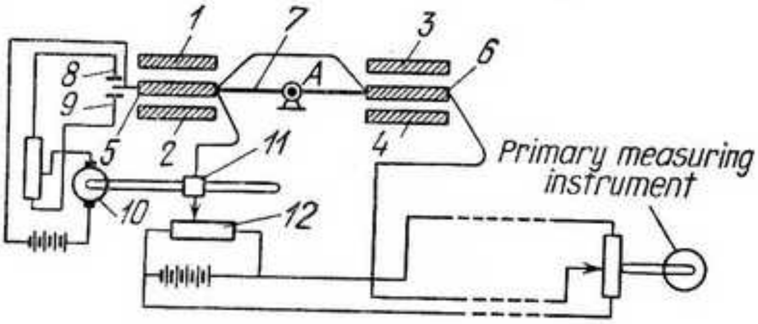
The mechanism is based on the principle of torque compensation, in which the torque of the movable system of primary measuring instrument *1* is compensated by the torque of the auxiliary device. Current producing the compensating torque is transmitted by a communication line and is measured at the receiving end. The shaft of polarized relay *4*, coaxial with primary measuring instrument *1* and linked to it through spiral spring *2*, carries contacting arm *3*, which, in turning, closes contacts at *9*. Connected in series with the winding of polarized relay *4* are receiving instrument *5*, power source *6*, self-inductor *7* and capacitor *8*. The contacts at *9* shunt capacitor *8* through resistor *10*. When the deflection of primary measuring instrument *1* equals zero, the contacts at *9* are open and the current in the line, as well as the reading of receiving instrument *5*, equals zero. When the movable system of instrument *1* is deflected, contacting arm *3* turns and closes the contacts at *9*. At this, the power source is in a closed circuit containing polarized relay *4*, receiving instrument *5*, self-inductor *7* and resistor *10*. In such a circuit, the current gradually builds up instead of being instantaneously established. At the instant when the growing torque of polarized relay *4* exceeds the torque developed by instrument *1*, arm *3* opens the contacts at *9* and the current in the line gradually drops to a value at which the torque of instrument *1* is again greater than that of relay *4*. Then the contacts at *9* are closed and the process is repeated. Thus, the current in the line pulsates and its average value is proportional to the torque of primary measuring instrument *1*.

4491	LEVER-TYPE REMOTE-READING MECHANISM FOR MEASURED ELECTRICAL QUANTITIES	LE M



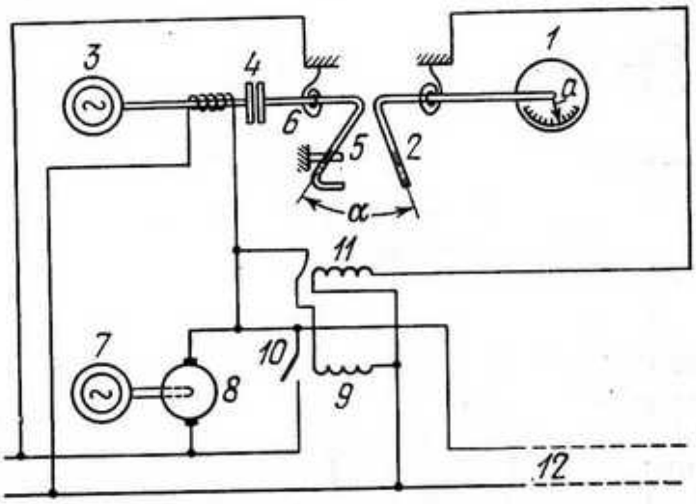
The electric current, whose measured value is to be transmitted for remote reading, is in fixed winding *1* of a moving-coil galvanometer, in which the angle through which movable coil *2* turns depends upon the current in winding *1*. Rigidly attached to coil *2* is hand *3*, which is periodically forced against resistor *4*. Hand *3* contacts resistor *4* by the action of dropping bow member *5*, actuated by electromagnet *6*. When the winding of electromagnet *6* is energized, bow member *5* is raised by lever *8*, which is connected to armature *9* of electromagnet *6* by tie-rod *10*. This frees hand *3*. When the winding of electromagnet *6* is de-energized, lever *8* is turned downward by spring *7*, freeing bow member *5*. Member *5* falls by gravity and forces hand *3* against resistor *4*.

4492	RECEIVING (REMOTE-READING) MECHANISM FOR MEASURED ELECTRICAL QUANTITIES	LE M



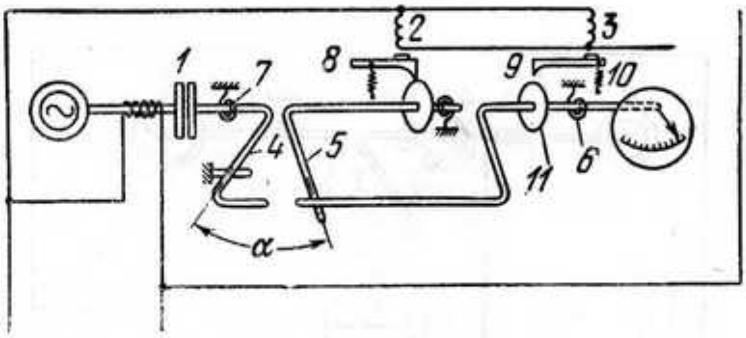
Used as the indicator is a device (the Kelvin balance) consisting of four fixed coils, *1*, *2*, *3* and *4*, between which are similar coils, *5* and *6*, mounted on lever *7*, which turns about fixed axis *A*. Coils *5* and *6* are connected in series. The balance is adjusted so that when there is no current in the windings of coils *5* and *6*, lever *7* is in its middle position, and the contacts at *8* and *9* are open. When the windings of coils *5* and *6* are energized, one pair of contacts, at *8* or *9*, is closed, switching on d-c electric motor *10*. The shaft of motor *10* is linked to the mechanism for traversing slider *11* of rheostat *12*. The direction of rotation of motor *10*, depending upon which pair of contacts, at *8* or *9*, is closed, should be selected in such a way that the mechanism compensates for the voltage due to the displacement of the moving system in the primary measuring instrument that led to the disturbance of equilibrium of the Kelvin balance.

4493	REMOTE-READING MECHANISM FOR MEASURED ELECTRICAL QUANTITIES	LE M



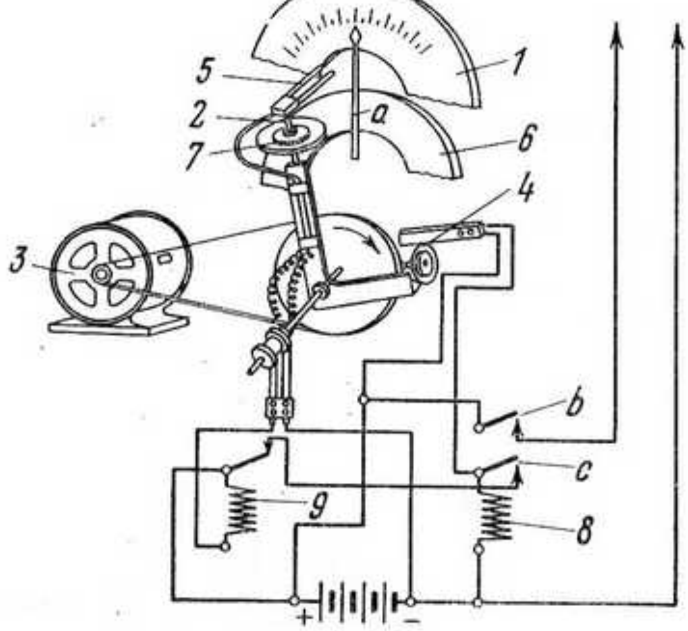
The instrument readings are converted into current pulses whose length is proportional to the angle of deflection of the hand of the primary measuring instrument. The mechanism consists of primary instrument *1*, whose shaft is brought out and ends as bent driving lug *2* with a contact. Electric motor *3* periodically rotates driving lug *5* through electromagnetic clutch *4*. Acting on lug *5* is spiral spring *6*. A second electric motor, *7*, continually rotates contactor *8*. When the contacts are closed by contactor *8*, electromagnetic clutch *4* is engaged and relay *9* is tripped. Relay *9* shunts contactor *8* by means of interlocking contacts at *10*, holding clutch *4* engaged as long as relay *9* is in the tripped position. As soon as clutch *4* is engaged, lug *5* begins to turn and, when it reaches lug *2*, closes the circuit of relay *11*. This relay opens the circuit of relay *9* and thereby disengages electromagnetic clutch *4* by opening contacts at *10*. As a result, the current that was in communication line *12* since contactor *8* closed its contacts, now disappears. Consequently, the length of the current pulse in the line turns out to be proportional to angle α of deflection of hand *a* of measuring instrument *1*.

4494 | **REMOTE-READING MECHANISM FOR MEASURED ELECTRICAL QUANTITIES** | LE M



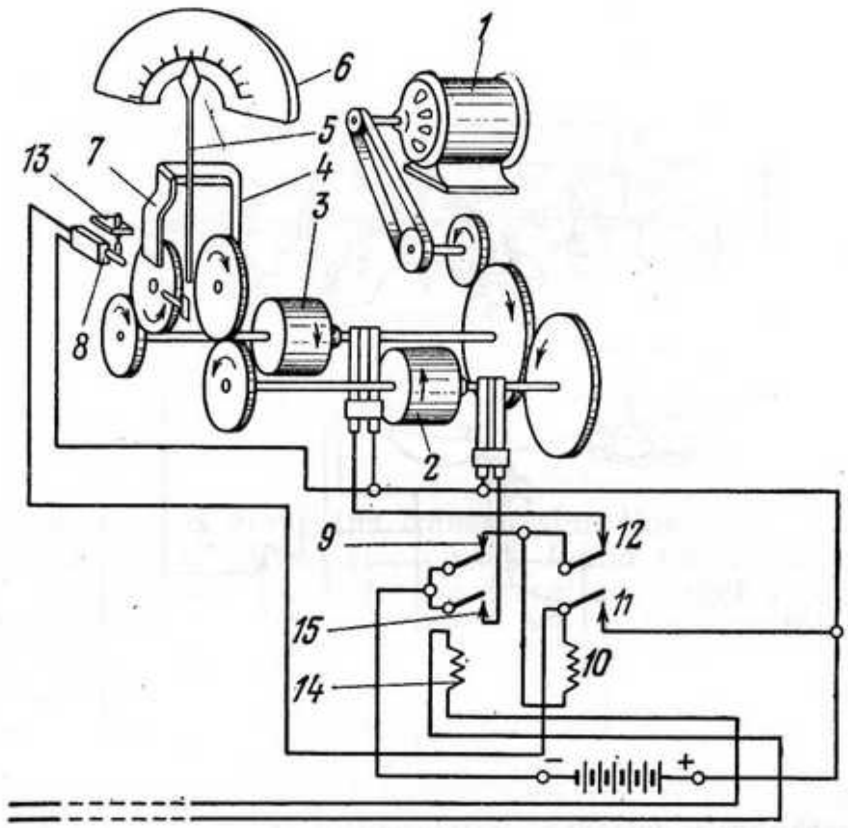
Current pulses, sent along the transmission line, pass through the winding of electromagnetic clutch *1* and the windings of relays *2* and *3*. When its winding is energized, clutch *1* engages a synchronous motor to driving lug *4* and begins to rotate this lug. Lug *4* engages and rotates lug *5*, whose braking detent *8* is retracted by relay *2*. At the end of the current pulse, clutch *1* is disengaged and relays *2* and *3* are switched off (their windings being de-energized). Driving lug *4* is returned to its initial position by spring *7*. Lug *5* remains stationary at the place where it was left by lug *4*, since relay *2* releases braking detent *8* which stops the shaft of lug *5*. When the winding of relay *3* is de-energized, the shaft of the receiving instrument is released because spring *10* retracts detent *9* from braking disk *11*. Spring *6* sets the shaft of the receiving instrument to the position of the hand of the transmitting instrument. In this position, the receiver can admit the next current pulse. If the quantity being measured has decreased, the process is repeated without any changes. If the quantity has increased, driving lug *4* additionally turns the shaft of the receiving instrument, overcoming the resistance of the brake, and sets it to the position corresponding to the new measured value. At the end of the pulse, all levers and other links, except the shaft of the receiving instrument, return to their initial positions.

4495	REMOTE-READING MECHANISM FOR MEASURED ELECTRICAL QUANTITIES	LE M



The mechanism is intended for transmitting the angle of deflection of the hand of the primary measuring instrument. Contacting device *2*, rotated slowly by synchronous motor *3*, is arranged in front of scale *1* of the measuring instrument whose readings are to be transmitted. As contacting device *2* rotates, two sets of contacts are closed: contacts at *4* are closed at the instant the contacting device runs past the zero point of scale *1*, and the contacts at *5* when the device passes hand *a* of the measuring instrument. This is accomplished as follows: contact ring *6* is arranged in the plane of scale *1* of the measuring instrument, close to hand *a*. Small rubber wheel *7* runs along ring *6*. When it approaches hand *a*, wheel *7* easily forces hand *a* against ring *6*, closing the contacts at *5*. The contacts at *4* are closed by relay *8*, which also closes two pairs of contacts at *b* and *c*. The contacts at *c* interlock relay *8* and those at *d* close the circuit of the communication line. Relay *8* remains closed until the contacts at *5* are closed. This closes relay *9* which breaks the holding circuit of relay *8*, thereby breaking the circuit of the communication line. Thus, the line has a current during the time contacting device *2* moves from the zero point of scale *1* to the position of hand *a* of the measuring instrument. Consequently, the length of the current pulse in the line at constant speed of motor *3* is proportional to the arc corresponding to the position of hand *a* of the instrument or, in other words, to the measured value.

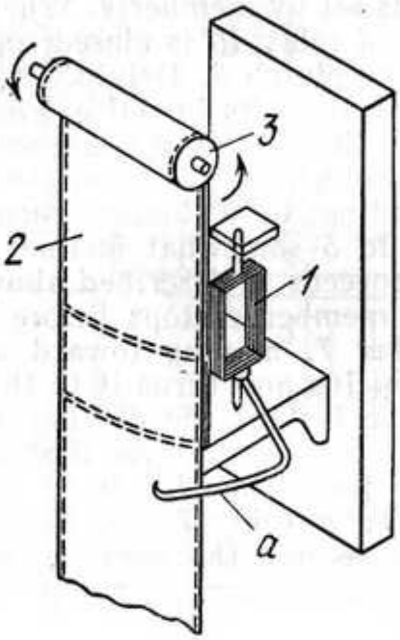
4496	LEVER-GEAR REMOTE-READING MECHANISM FOR MEASURED ELECTRICAL QUANTITIES	LE M



Electric motor *1* rotates two electromagnetic clutches, *2* and *3*, in different directions. Clutch *2* rotates driving member *4* in the direction of rotation of hand *5* of the receiving instrument, which consists of scale *6*, similar to the scale of the transmitting instrument, and a shaft carrying hand *5*, turning with slight friction. Clutch *3* rotates driving member *7*, turning in the direction opposite to that of member *4*. At the beginning of transmission, when there are no pulses in the line, driving member *4* is in its extreme left-hand position, in which it closes the contacts at *8*. Through contacts at *9*, this energizes relay *10*. The latter, interlocked by contacts at *11*, opens the circuit of electromagnetic clutch *3* by the contacts at *12*. At this, driving member *7* is in its extreme right-hand position. When a current pulse reaches relay *14*, connected into the communication line, this relay opens the contacts at *9* and closes the circuit of electromagnetic clutch *2* by means of contacts at *15*. Clutch *2* rotates hand *5* to the position coinciding with the position of the identical transmitter hand. At the instant that hand *5* reaches this position, the current pulse

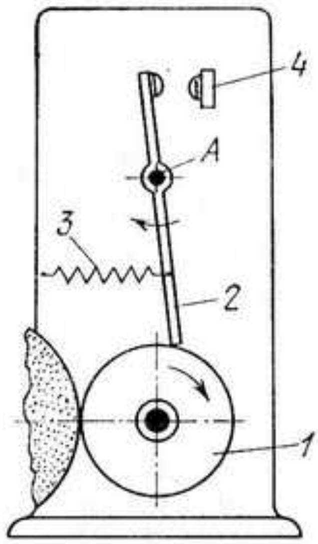
ends in the line and relay *14*, releasing its armature and closing the contacts at *9*, opens the contacts at *15*, disengaging clutch *2*. The closing of contacts at *9* engages clutch *3*. As a result, driving member *7*, moving toward member *4*, engages this member and turns it to its extreme left-hand position, leaving hand *5* in the position it was set by member *4*. When member *4* reaches stop *13*, the circuit of relay *10* is closed, opening the contacts at *12* and disengaging clutch *3*. Driving member *7* is returned by a spring (not shown) to its initial extreme right-hand position. In this position the reading mechanism is ready to receive the next current pulse. If, in this case, the measured quantity increases, corresponding to a longer current pulse, driving member *4* turns hand *5* somewhat farther along scale *6*, and the whole process proceeds as described above. If the measured quantity decreases, member *4* stops before it reaches hand *5*. Then driving member *7*, moving toward member *4*, engages hand *5* with a special lug and turns it to the position occupied by member *4*. At the instant the driving members meet each other, the lug frees hand *5* and leaves it stationary while member *4* is returned to its exreme left-hand position. The spring again retracts driving member *7* and the reading mechanism is ready to receive the next current pulses.

4497	MAGNETOELECTRIC (MOVING-COIL) RECORDING MECHANISM	LE M



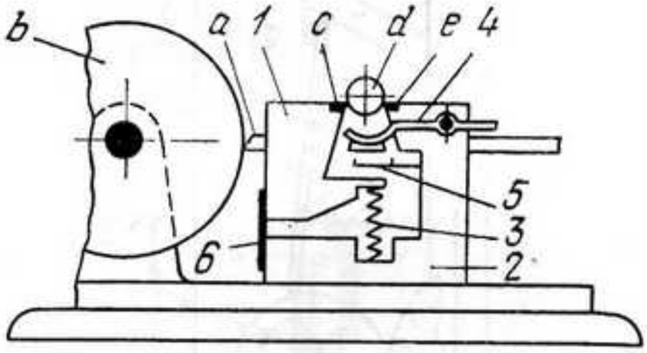
When the winding of coil *1*, arranged in the field of a permanent magnet, is energized, the coil turns about its axis. Recording arm *a*, mounted rigidly on coil *1*, slides with its pen on paper tape *2*, transported by winder roller *3* along a guide that is bent to a cylindrical shape.

4498	LEVER-TYPE ELECTRIC-CONTACT AUTOMATIC SIZING MECHANISM FOR A GRINDER	LE M



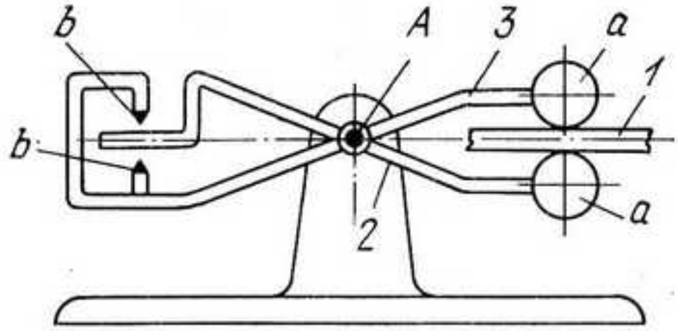
As the diameter of workpiece *1* being ground decreases, lever *2*, turned by spring *3* about fixed axis *A*, slips over to its left-hand position when the proper size is reached. This closes the contacts at *4*, operating the actuating mechanism which switches off the grinder.

4499	LEVER-TYPE ELECTRIC-CONTACT AUTOMATIC SIZING MECHANISM FOR A GRINDER	LE M



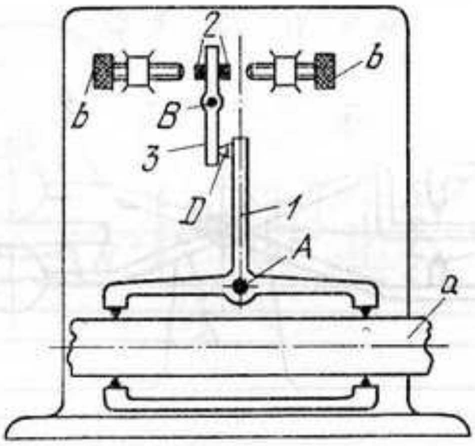
Measuring tip *a*, mounted on holder *1*, slides along the surface of workpiece *b* being ground. Holder *1* is linked to slide *2* by flexible flat steel spring (reed) *6*, allowing it to turn to some extent. Gauge *d* is supported by lugs *c* and *e* on holder *1* and slide *2*. Spring *3*, arranged between slide *2* and holder *1*, tends to turn holder *1* counterclockwise as the workpiece diameter is reduced and holds tip *a* against the surface of workpiece *b*. As soon as the workpiece is ground to the required size, holder *1* turns sufficiently to allow gauge *d* to drop between lugs *c* and *e* onto lever *4*. This closes the electric contacts at *5*, and switches on a mechanism that retracts slide *2* from workpiece *b* and switches off the grinding wheel.

4500	LEVER-TYPE ELECTRIC-CONTACT BAND THICKNESS GAUGE MECHANISM	LE M



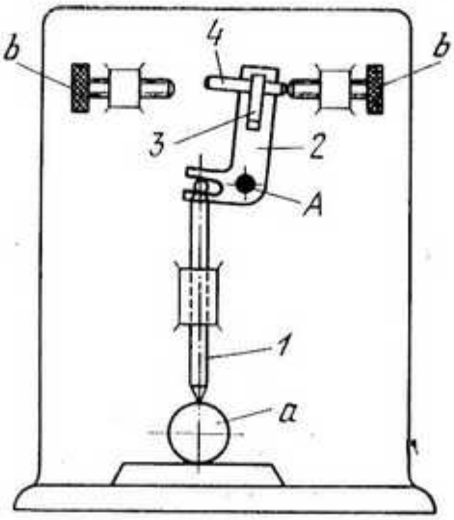
Levers *2* and *3* turn freely about common fixed axis *A*. Lever *3* carries contacts *b*. Steel band *1* being gauged is pulled between two rollers *a*, mounted on levers *2* and *3*. When the thickness of the band passing between rollers *a* is greater or less than the permissible values, one of the pairs of contacts at *b* is closed, switching on the over- or undersize signal lamp.

4501	LEVER-TYPE ELECTRIC-CONTACT TAPER INSPECTION MECHANISM FOR CYLINDRICAL WORKPIECES	LE M



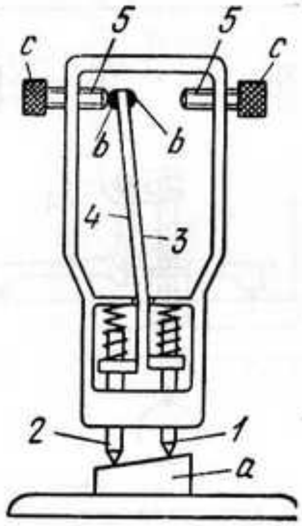
With its boss D, contact lever 1, turning about fixed axis A, engages lever 3, turning about fixed axis B and carrying contacts 2. In inspecting cylindrical or prismatic workpiece a, having equal thicknesses at the points inspected, contact lever 1 is in its central position and both pairs of contacts at 2 remain open. If the workpiece is tapered or has nonparallel longitudinal faces, contact lever 1 turns about axis A and closes one pair of contacts at 2. The contacts at 2 are set to the required taper tolerance by screws b.

4502	LEVER-TYPE ELECTRIC-CONTACT ROUNDNESS INSPECTION MECHANISM	LE M



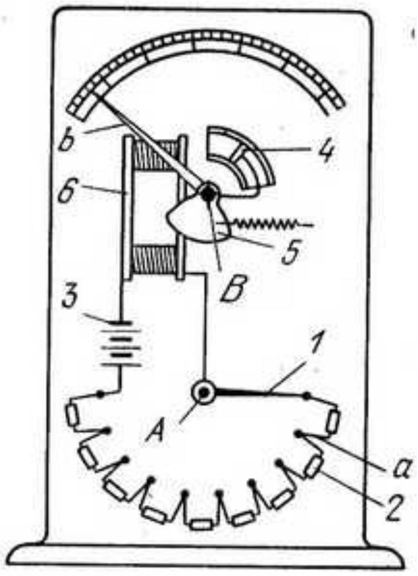
When workpiece *a* being inspected is rotated between a stationary flat surface and measuring spindle *1*, out-of-roundness of the workpiece displaces lever *2*, which turns about fixed axis *A*. Lever *2* has a V-slot at its upper end, in which cylindrical contact pin *4* is held by flat spring *3*. Mounted on the upright of the inspection device are two micrometric screws *b*, used to set the device to the limits of the tolerance zone. As lever *2* turns to either side, contact pin *4* runs up against one of the micrometric screws and stops moving. If, for instance, the out-of-roundness of workpiece *a* exceeds the permissible value, contact pin *4* touches one of screws *b*. This closes an electric circuit that switches on the "Reject" signal lamp.

4503	LEVER-TYPE ELASTIC-LINK ELECTRIC-CONTACT PARALLELISM CHECKING MECHANISM FOR WORKPIECES	LE M



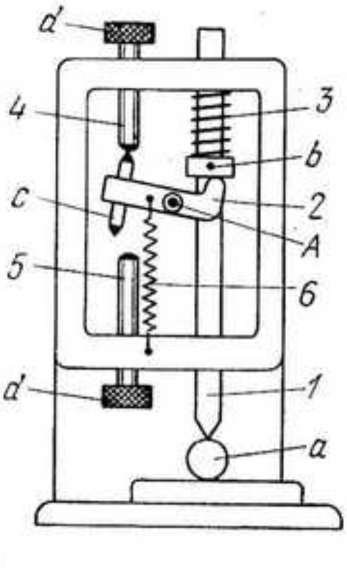
Two pointed pins, *1* and *2*, are lowered into contact with the upper flat surface of workpiece *a* being inspected. Rigidly attached to the pins are two flat springs (reeds), *3* and *4*, whose upper ends are fastened together and carry contacts *b*. If the faces of the workpiece being inspected are parallel, then measuring pins *1* and *2* are raised to equal heights, and flat springs *3* and *4* remain in the middle position without being bent. Upon lack of parallelism of the workpiece faces, pins *1* and *2* are raised to different heights, flat springs *3* and *4* bend and one of the pairs of contacts at *5* is closed. The contacts are set to the limits of the parallelism tolerance by adjusting screws *c*.

4504	**LEVER-TYPE SECTIONAL RHEOSTAT MECHANISM FOR AN ELECTRIC INSTRUMENT**	**LE M**



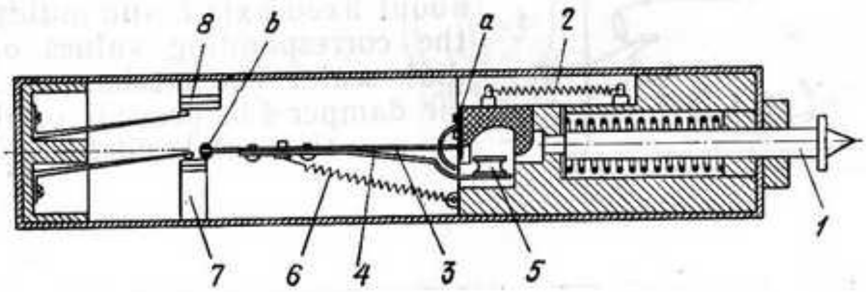
When lever *1* is turned about fixed axis *A* from one contact *a* to the next, resistors *2* are consecutively switched in or out of the circuit. This changes the current in the circuit at constant voltage of battery *3*. Varying with the current is the deflection of armature *5* of electromagnet *6*. Hand *b*, rigidly attached to armature *5*, turns about fixed axis *B* and indicates the corresponding values on a dial scale. The mechanism has air damper *4* to prevent oscillations of hand *b*.

4505	**LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION**	**LE M**



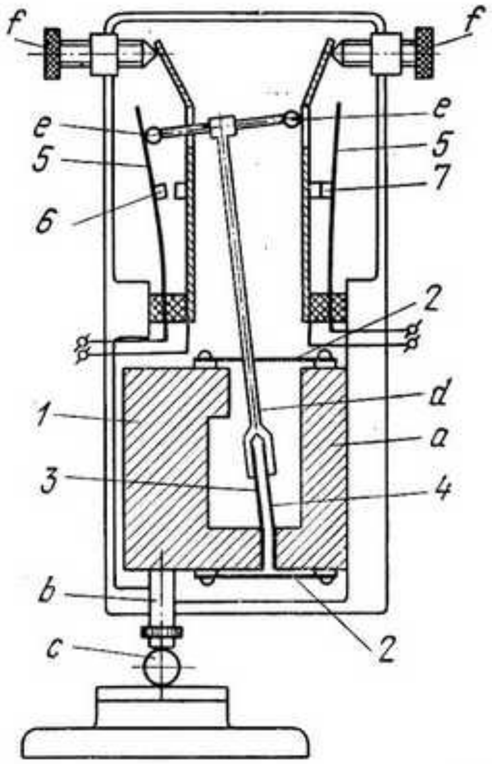
Mounted on measuring spindle *1*, contacting workpiece *a* being inspected, is collar *b*, which transmits the displacement of spindle *1* to lever *2*, turning about fixed axis *A*. In inspecting an undersize workpiece, contacts *c* and *4* are closed by the action of spring *3*, thereby switching on the "Undersize" signal lamp. In inspecting an oversize workpiece, contacts *c* (lower) and *5* are closed by the action of another spring *6*, switching on the "Oversize" signal lamp. Contacts *4* and *5* are set to the limits of size by screws *d*.

LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION



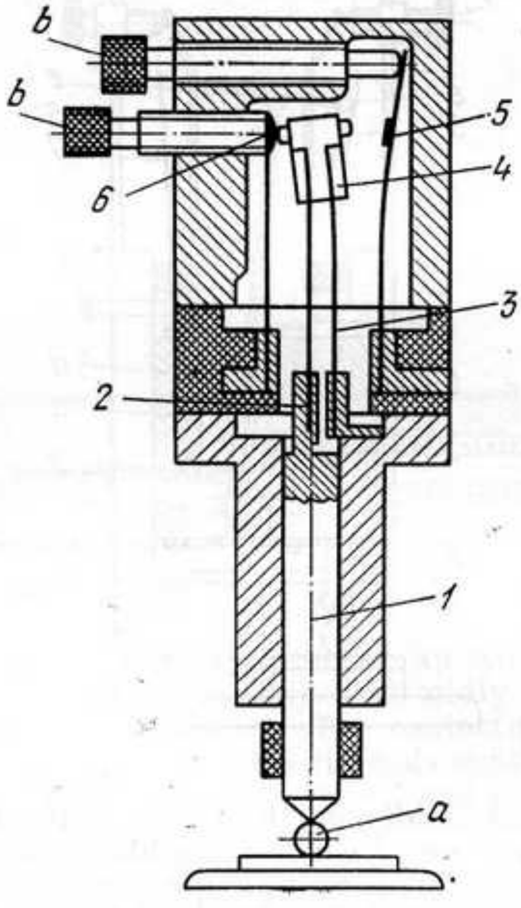
Measuring spindle *1*, contacting the workpiece being inspected, is moved to the right by spring *2*. Rigidly mounted at the left end of spindle *1* is strip *a*. The contacting lever consists of striplike fork member *3*, with its ends supported in recesses of the housing, bent arm *4*, and roller *5* and contact *b* mounted on arm *4*. Spring *6* holds fork member *3* against contact *7* and roller *5* against strip *a*. When spindle *1* is displaced to the left by the workpiece, the contacts at *7* are opened and those at *8* are closed.

4507	LEVER-TYPE ELASTIC-LINK ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



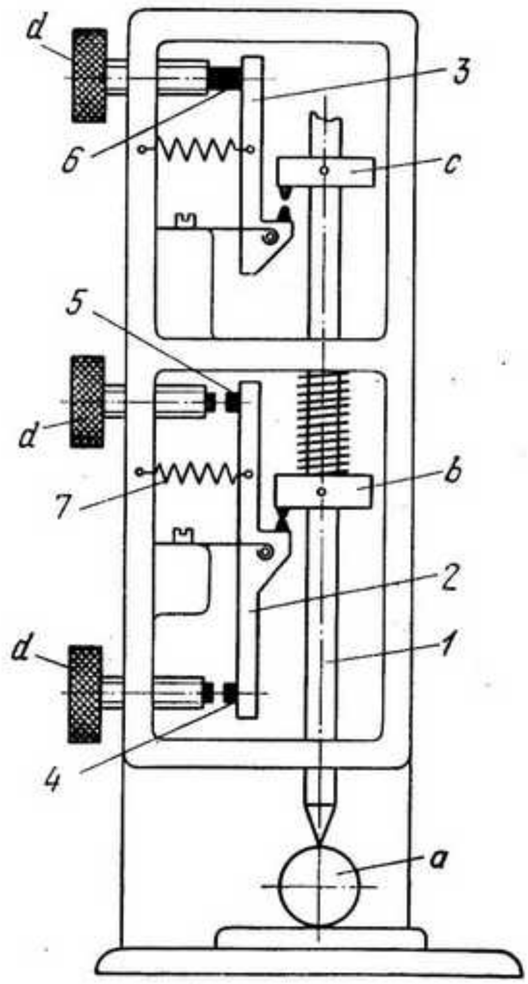
Block *a*, mounted rigidly on the frame of the device, has two flat steel springs (reeds) *2* which carry block *1* on which measuring spindle *b* is mounted. Spindle *b* contacts workpiece *c* being inspected. Two flat steel springs (reeds) *3* and *4*, with their lower ends mounted on blocks *1* and *a*, one on each block, have their upper ends rigidly fastened together and attached to lever *d*. Depending upon the size of the workpiece, block *1* is raised or lowered, bending springs *3* and *4*, and deflecting lever *d* to the right or left. At this, one of the balls *e*, made of an insulating material, bears against the corresponding spring *5*, opening the contacts at *6* or *7* and switching on the "Oversize" or "Undersize" signal lamp. Contacts *6* and *7* are set to the limits of size by screws *f*.

4508	LEVER-TYPE ELASTIC-LINK ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



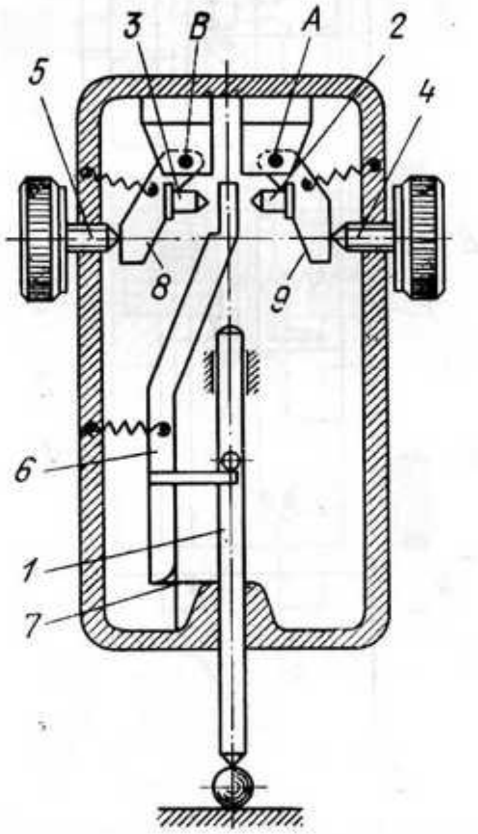
Measuring spindle *1*, contacting workpiece *a* being inspected, has at its upper end rigidly attached flat steel spring (reed) *2*. Spring *3* is attached to the housing of the inspection instrument. The upper ends of springs *2* and *3* are attached rigidly to block *4*. When workpiece *a* is oversize or undersize, spindle *1* is raised or lowered, bending springs *2* and *3* to the right or left so that block *4* closes contacts at *5* or *6* to switch on the "Oversize" or "Undersize" signal lamp. Contacts *5* and *6* are set to the limits of size by screws *b*.

4509	LEVER-TYPE TRIPLE-ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



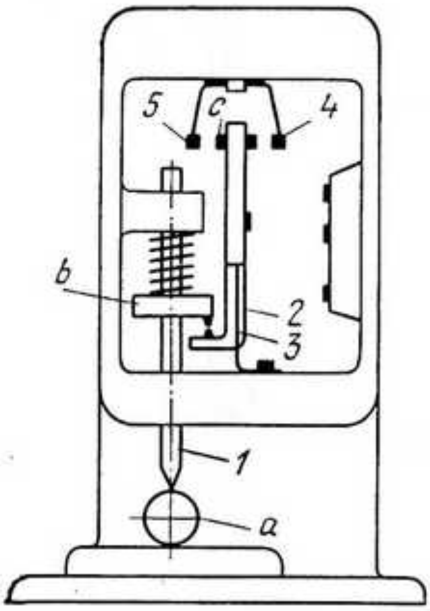
Mounted on measuring spindle *1*, contacting workpiece *a* being inspected, are two collars, *b* and *c*, which transmit the displacement of spindle *1* to levers *2* and *3*. Levers *2* and *3* are mounted on the housing with flat steel springs (reeds). This triple-contact inspection device enables the workpieces to be sorted into four size groups. When the workpiece is in the first size group, contacts at both *4* and *5* remain open, and the contacts at *6* are closed. When the workpiece is in the second group (of a size larger than in the first group), the contacts at *5* are closed by spring *7*. When the workpiece is in the third group (of a size smaller than in the first group), the contacts at *5* are opened and those at *4* are closed. When the workpiece is in the fourth group (of a size smaller than in the third group), the contacts at *6* are opened. The contacts are set to the limits of size of the groups by screws *d*.

4510	LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



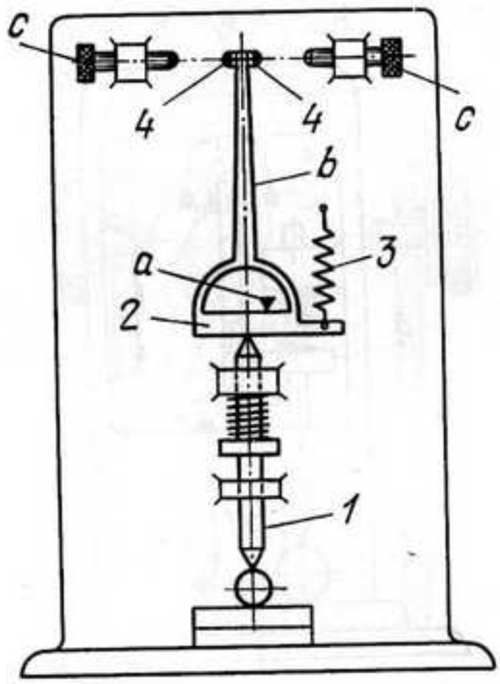
Contact pins *2* and *3* are rigidly mounted on levers *9* and *8*, which turn about fixed axes *A* and *B*. The instrument is set up by gauge blocks placed under measuring spindle *1*. Contact pin *2* is set to the lower limit of size by screw *4*, and pin *3* to the upper limit of size by screw *5*. Each contact pin is connected to a signal lamp, which is switched on to signal that the workpiece is undersize or oversize, and to be rejected. Lever *6*, actuated by spindle *1*, is mounted on flat steel springs (reeds) 7.

4511	LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



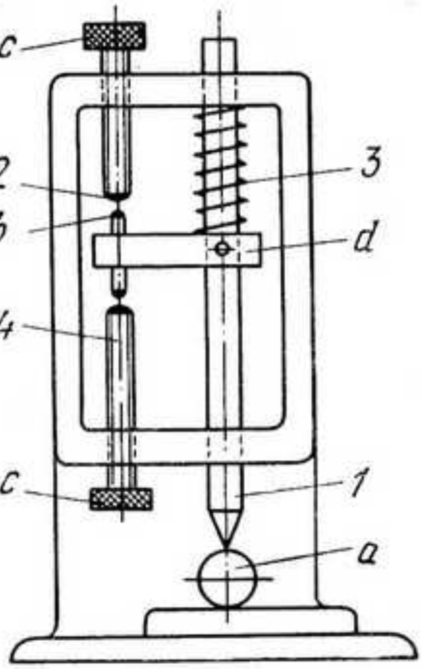
Mounted on measuring spindle *1*, contacting workpiece *a* being inspected, is collar *b*. Lever *2* is mounted on flat steel spring (reed) *3* and held by this spring with the short arm of lever *2* against collar *b* of the spindle. In inspecting a within-size workpiece, collar *b* holds lever *2* in its middle position between contacts *4* and *5*. When the workpiece is undersize or oversize, contacts *c* and *5* or *c* and *4* are closed, switching on the "Undersize" or "Oversize" signal lamp. Contacts *c* are rigidly mounted on lever *2*.

4512	LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



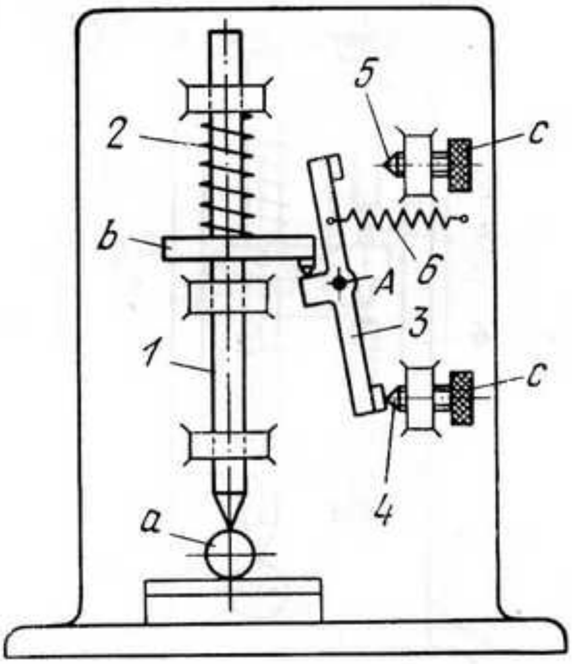
The upper end of measuring spindle *1* actuates crosspiece *2*, which turns about knife edge *a*. In inspecting within-size workpieces (under measuring spindle *1*), crosspiece *2* is held in its middle position. When the workpiece is oversize or undersize, beam *b* is swung by spindle *1* to the right or left, closing one of the pairs of contacts at *4* and switching on the corresponding "Oversize" or "Undersize" signal lamp. The contacts are set to the limits of size by screws *c*.

4513	ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



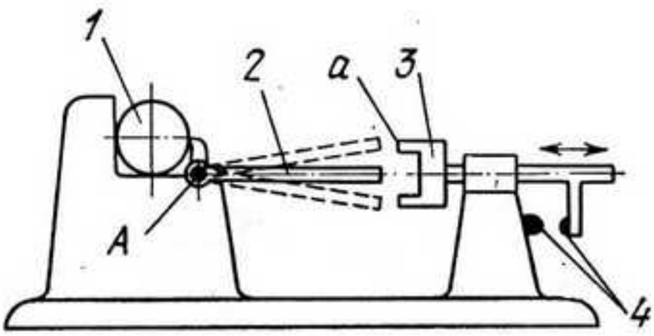
Mounted on measuring spindle *1*, contacting workpiece *a* being inspected, is yoke *d*, into which double-ended tungsten contact *b* is pressfitted. In inspecting an undersize workpiece, contact *b* is pushed against stationary contact *4* by spring *3*, closing the circuit of the "Undersize" signal lamp. In inspecting an oversize workpiece, contact *b* is pushed against stationary contact *2*, closing the circuit of the "Oversize" signal lamp. Contacts *2* and *4* are set to the limits of size by screws *c*.

4514	LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



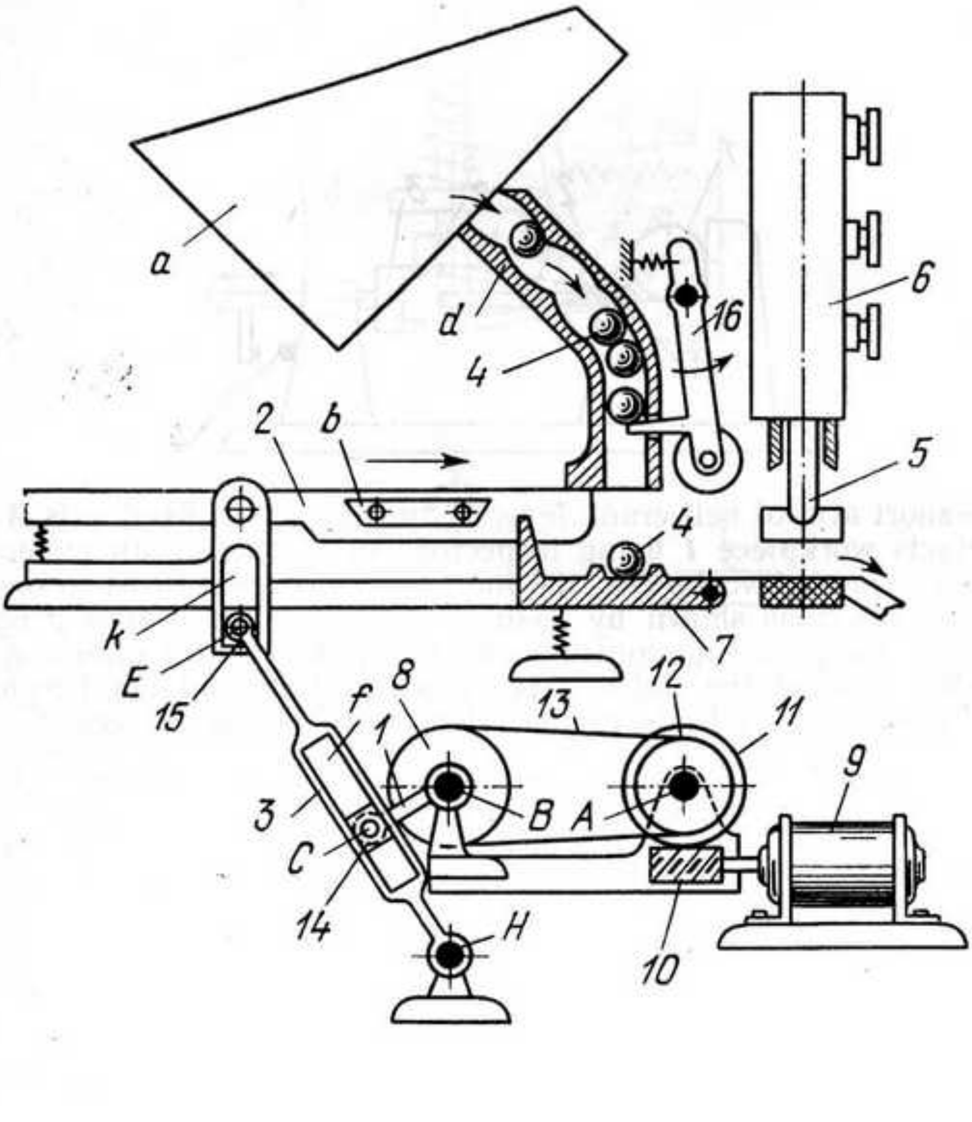
Mounted on measuring spindle *1*, contacting workpiece *a* being inspected, is yoke *b*, held by spring *2* against the short arm of three-arm lever *3*, turning about fixed axis *A*. Contacts are rigidly mounted on the long arms of lever *3*. When within-size workpieces are inspected, lever *3* is in its middle position. In inspecting an undersize workpiece, lever *3* closes the contacts at *4*, closing the circuit of the "Undersize" signal lamp. In inspecting an oversize workpiece, spring *6* turns lever *3* to close the contacts at *5*, closing the circuit of the "Oversize" signal lamp. Contacts *4* and *5* are set to the limits of size by screws *c*.

4515	LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	LE M



The short arm of bell-crank lever *2*, turning about fixed axis *A*, contacts workpiece *1* being inspected. In inspecting an undersize or oversize workpiece, the long arm of lever *2* turns to one of the positions shown by dash lines. Then one of lugs *a* on head *3*, reciprocating continuously in the horizontal direction, runs up against the end of lever *2*, preventing contacts *4* from closing. This leads to the rejection of the workpiece.

4516	LEVER-TYPE ELECTRIC-CONTACT DIAMETER CHECKING MECHANISM FOR CYLINDRICAL WORKPIECES	LE M

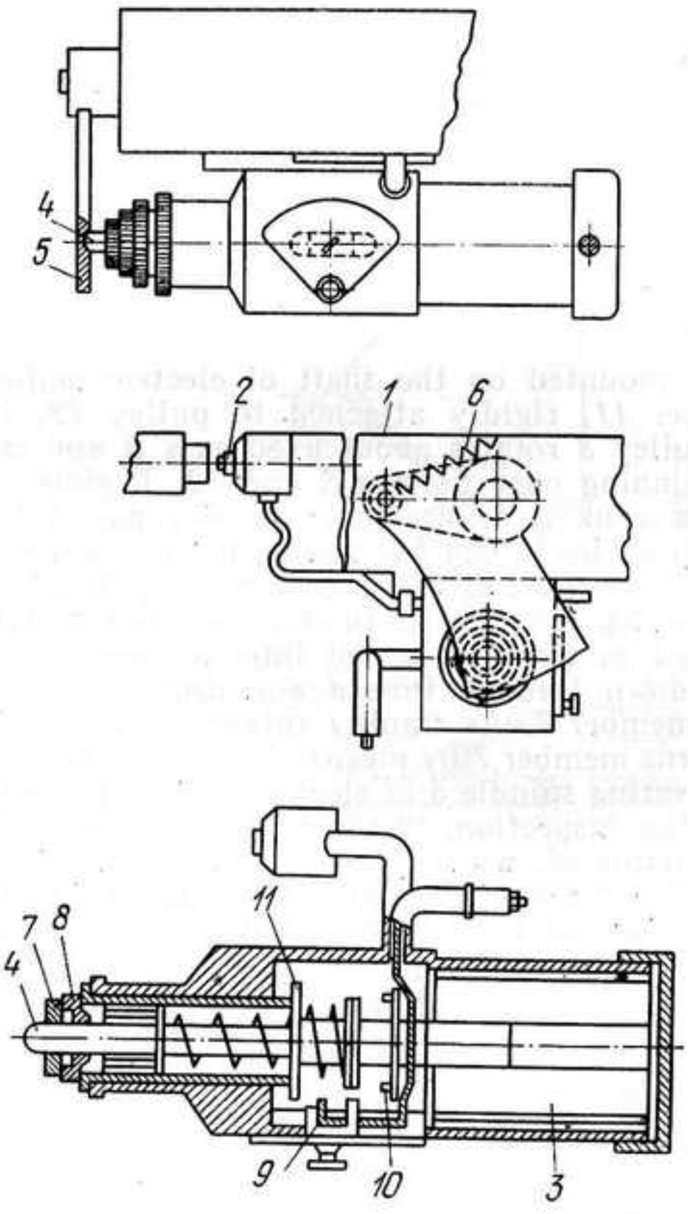


4516	LEVER-TYPE ELECTRIC-CONTACT DIAMETER CHECKING MECHANISM FOR CYLINDRICAL WORKPIECES	LE M

Worm *10*, mounted on the shaft of electric motor *9*, drives worm wheel *11*, rigidly attached to pulley *12*, about fixed axis *A*. Pulley *8* rotates about fixed axis *B* and is driven by belt *13*, running over pulleys *8* and *12*. Rigidly attached to pulley *8* is crank *1*, connected by turning pair *C* to slider *14*, which reciprocates in slot *f* of slotted lever *3*. Lever *3* oscillates about fixed axis *H*. Lever *3* is connected by turning pair *E* to slider *15*, which reciprocates in slot *k* of slide *2*. Workpieces *4* being sorted in size are loaded into magazine *a* from where they roll down through tube *d* and drop, one by one, onto receiving member *7*. As crank *1* rotates, slide *2*, advanced by lever *3*, turns member *7* by means of dog *b*, feeding workpiece *4* under measuring spindle *5* of electric-contact inspection instrument *6*. After inspection, in which the size group of the workpiece is determined, workpiece *4* is delivered further by slide *2* to the sorting mechanism. Latch lever *16*, which releases the workpieces one at a time, is operated by a lug of slide *2*.

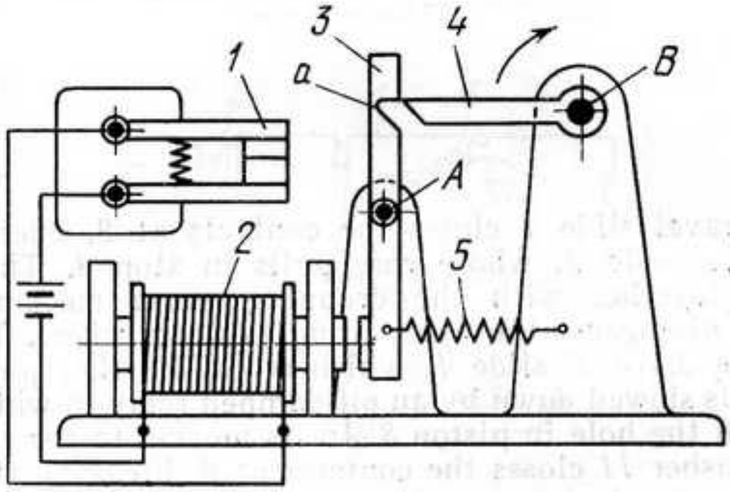
4. STOP, DETENT AND LOCKING MECHANISMS
(4517, 4518 and 4519)

4517	LEVER-TYPE AUTOMATIC STOP MECHANISM	LE SD



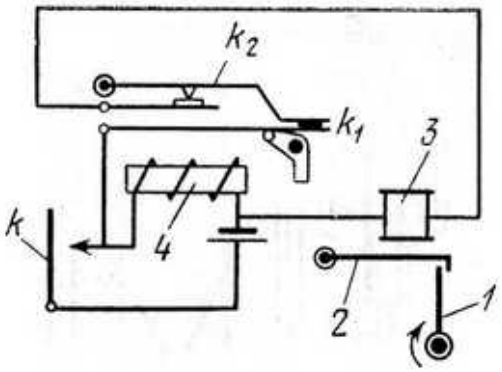
In its travel slide *1* closes the contacts at *2*, energizing the coil of solenoid *3*, whose core pulls in stop *4*. This releases strip *5* together with the dropping worm mechanism, and spring *6* disengages the worm from its worm wheel. This disengages the drive of slide *1*, which stops. Further pulling-in of the core is slowed down by an oil-damped relay in which valve *7* blocks off the hole in piston *8*. In its motion to the right, insulating washer *11* closes the contacts at *9*, breaking the holding circuit of the electromagnetic starter. A supplementary pair of contacts, automatically closed by button *10*, is provided for the case in which the contacts at *2* are unintentionally opened.

4518	LEVER-TYPE ELECTROMAGNETIC STOP MECHANISM	LE SD



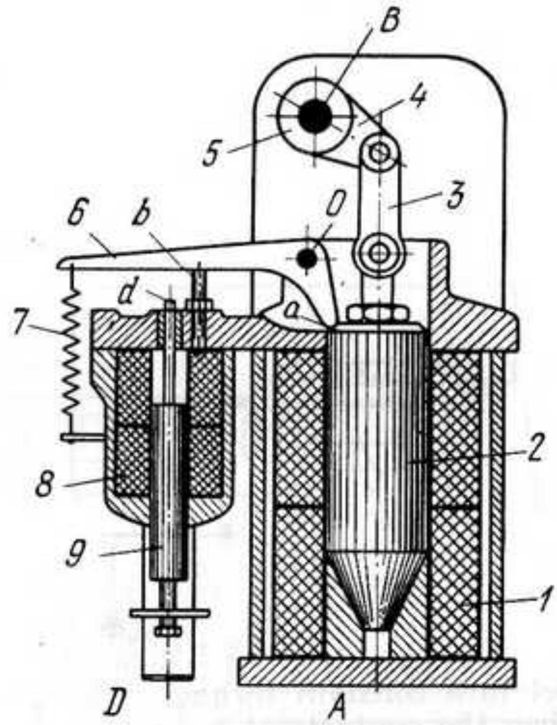
When the circuit is closed by switch *1*, the coil of electromagnet *2* is energized. Armature *3*, turning about fixed axis *A*, is attracted to electromagnet *2* and its slot *a* locks crank *4*, rotating about fixed axis *B*. When switch *1* is switched off, armature *3* is returned to its initial position by spring *5*, releasing crank *4*.

4519	LEVER-TYPE ELECTROMAGNETIC STOP MECHANISM	LE SD



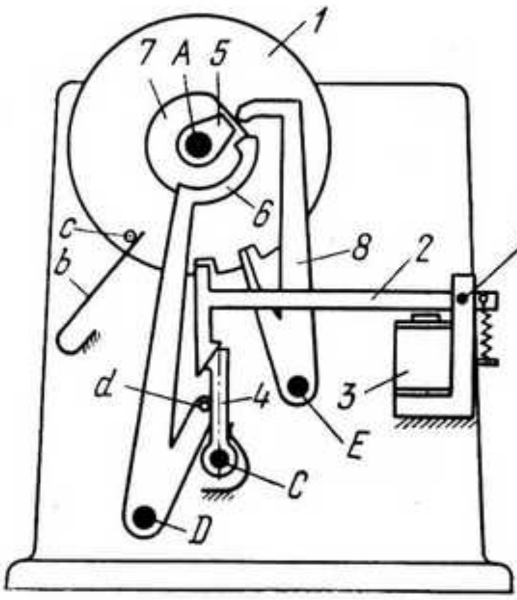
Lever *1*, subject to a constant torque, is held against rotation by latch *2*. When the contacts at k are closed, relay *4* is energized and closes the spring contacts at k_1, which, in turn, energize starter electromagnet *3*, connected in parallel with electromagnet *4*. Electromagnet *3* attracts latch *2*, releasing lever *1*. The contacts at k_2 de-energize electromagnet *3* with a certain delay after the contacts at k_1 are closed. Thus, lever *1* stops after making one revolution.

4520	SLIDER-CRANK SOLENOID DRIVE MECHANISM	LE Dr



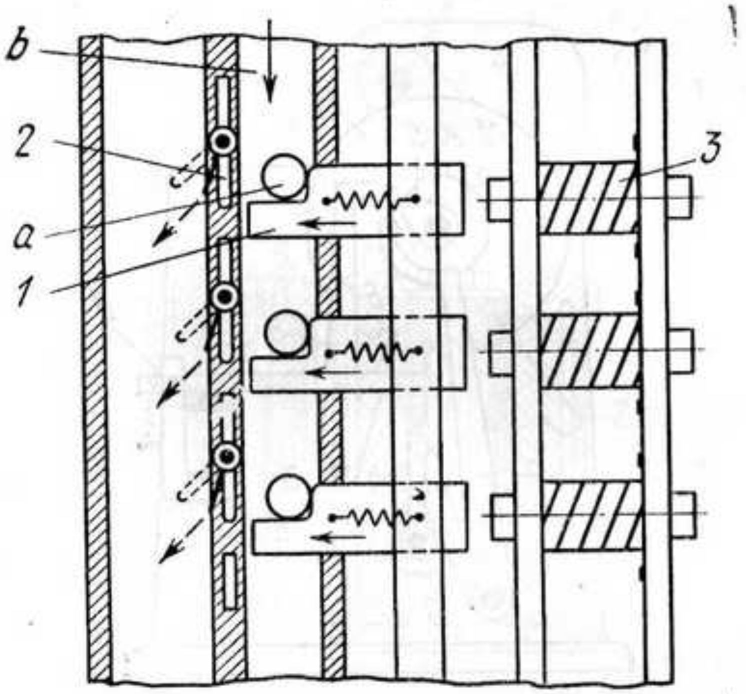
When coil *1* is energized, core *2* of solenoid *A* is pulled into the coil. The reciprocating motion of core *2* is converted by connecting rod *3* and crank *4* into rotary motion of driven shaft *5* about fixed axis *B*. Crank *4* is rigidly mounted on shaft *5*. Lever *6*, turning about fixed axis *O*, is held by spring *7* in a definite position against stop screw *b*. Screw *b* is mounted on the bracket of the drive. At the end of the upward stroke of core *2*, its upper bevel *a* engages the short arm of lever *6*. The drive is disengaged by solenoid *D*. When coil *8* is energized, core *9* is pulled into the coil and striker *d*, fastened to the upper end of core *9*, runs up against lever *6*, turning it clockwise about axis *O*. At this, the other end of lever *6* slips off bevel *a* on core *2* of solenoid *A*, releasing shaft *5*, which is returned to its initial position by a helical spring (not shown). At the end of the process, core *9* is returned to its initial position by a spring (not shown).

4521	RATCHET-LEVER ELECTROMAGNETIC PERIODIC DRIVE MECHANISM	LE Dr



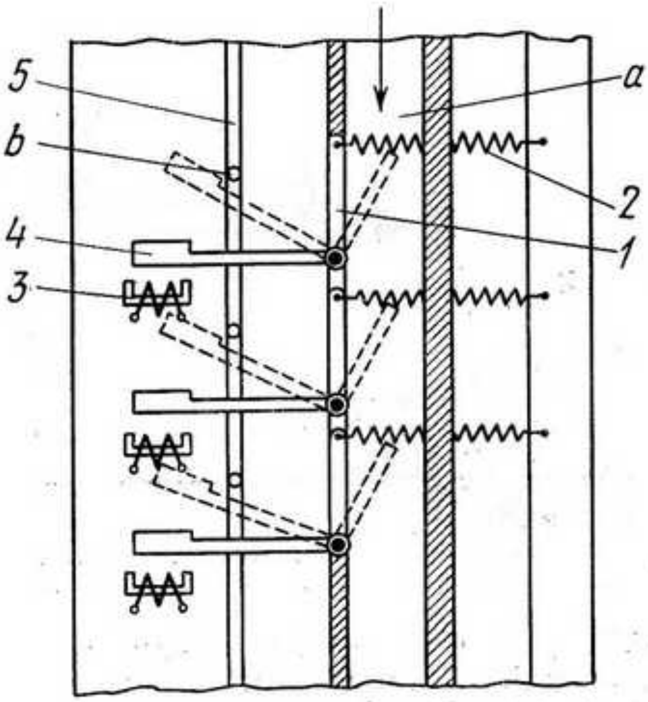
Disk *1*, mounted freely on shaft *A*, is held stationary by armature *2*, turning about fixed axis *B*. When electromagnet *3* is energized, it attracts armature *2*, which turns counterclockwise and is locked by latch *4*, turning about fixed axis *C*. This frees disk *1* which is turned through a certain angle by flat spring *b*, bearing against pin *c*. At a definite instant, cam *5*, mounted rigidly on shaft *A*, turns lever *6* about fixed axis *D*. With its pin *d*, lever *6* retracts latch *4*, releasing armature *2*. Cam *7* actuates lever *8*, turning about fixed axis *E*, which turns disk *1* to the normal position.

4522	LEVER-TYPE ELECTROMAGNETIC SORTING MECHANISM	LE SF



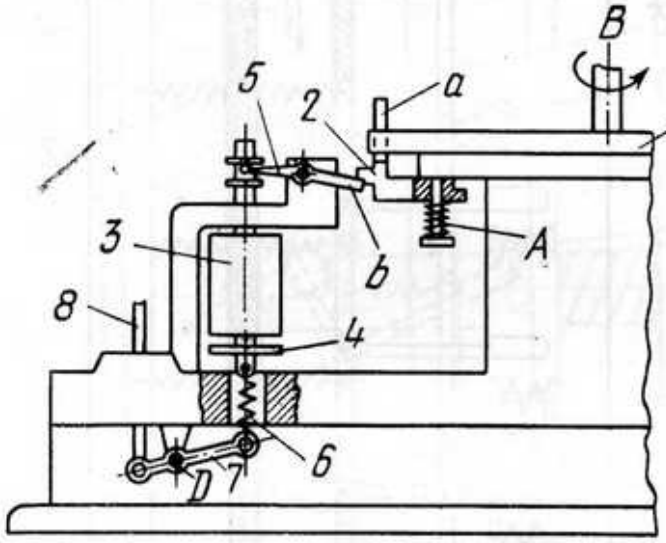
The mechanism enables several parameters of the workpiece to be inspected for sorting purposes. Workpiece *a* to be inspected is dropped into vertical channel *b* and is held up by slide block *1*. In this position, an inspection operation is performed by some measuring facility. If the workpiece is to be rejected, the measuring facility switches on a mechanism moving slide block *1* to the left. The slide block turns away spring-loaded shutter *2* and rejected workpiece *a* is ejected to the side. If the workpiece is within size, the measuring facility energizes electromagnet *3*, which pulls slide block *1* to the right, releasing workpiece *a* so that it drops onto the next slide block. This is the next station where other dimensions of the workpiece are inspected.

LEVER-TYPE ELECTROMAGNETIC SORTING MECHANISM



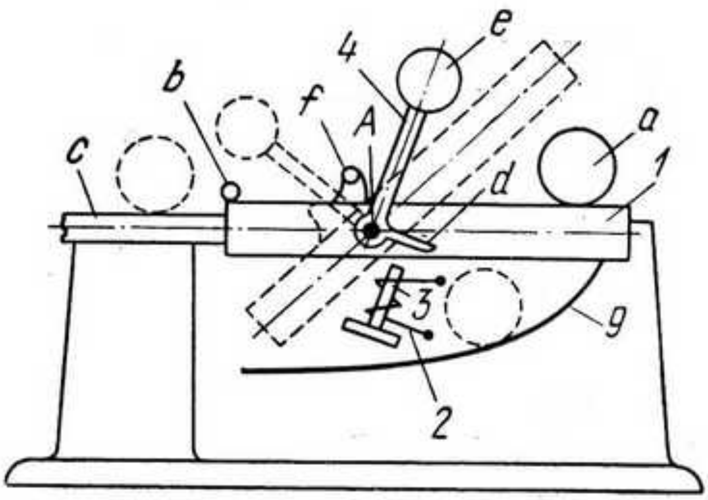
The workpiece is dropped into vertical channel *a*, along which shutters *1* are arranged. Springs *2* tend to retract the shutters and direct the workpieces into the side channels, but electromagnets *3* hold armatures *4* so that shutters *1* are in the vertical position and the workpiece can drop through. When a workpiece belonging to one of the size groups passes through, the corresponding electromagnet is de-energized so that the armature is released. At this the corresponding shutter closes the vertical channel and the workpiece is directed to a side channel. At the end of the cycle, tie-rod *5*, reciprocating vertically, returns the shutter to its initial position by means of pin *b*.

4524	LEVER-TYPE ELECTROMAGNETIC SORTING MECHANISM	LE SF



Horizontal disk *1*, rotating about fixed axis *B*, carries workpieces *a* being inspected in recesses arranged around the circumference. The lower end of workpieces *a* rests on support blocks *2* provided under each recess. When a rejected workpiece reaches this station, the inspection device de-energizes the winding of electromagnet *3*. Then armature *4* is pulled downward by spring *6*, raising end *b* of lever *5*. As disk *1* turns, support block *2* runs against lever *5* and turns about axis *A*, releasing the workpiece which drops downward. The tension of spring *6* is adjusted by turning lever *7* about fixed axis *D* and clamping it in the required position by means of link *8*.

4525	LEVER-TYPE ELECTROMAGNETIC SORTING MECHANISM FOR HEAVY WORKPIECES	LE SF



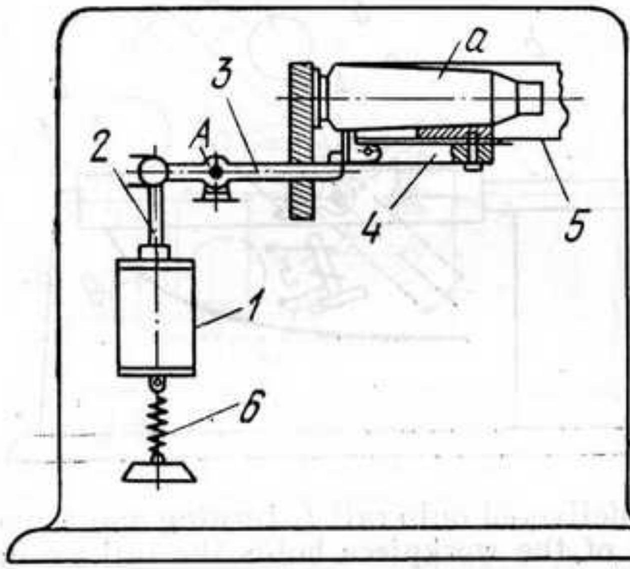
Workpiece *a* is delivered onto rail *1*, turning about fixed axis *A*, and the weight of the workpiece holds the rail against stop *b*. Within-size workpieces roll along rail *1* and onto fixed guides *c*. If a rejected workpiece is being delivered, the winding of electromagnet *2* is energized, armature *3* of the electromagnet is attracted so that it strikes arm *d* of lever *4*, turning the lever with its counterweight *e* to the position indicated by dash lines. At this, lever *4* engages pin *f* and turns rail *1* counterclockwise to the position shown by dash lines. Then the rejected workpiece is not delivered onto rail *1*, but drops under the rail and rolls along guide chute *g* to the reject box. As it rolls, the ejected workpiece engages the lower end of rail *1* and turns it, together with lever *4* and counterweight *e* to the initial position.

4526

LEVER-TYPE ELECTROMAGNETIC SORTING MECHANISM FOR CARTRIDGE CASES

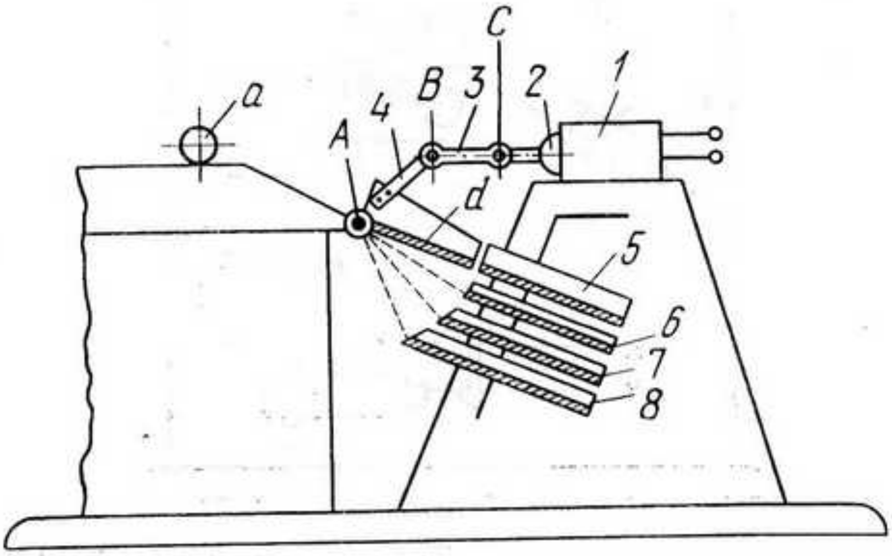
LE

SF



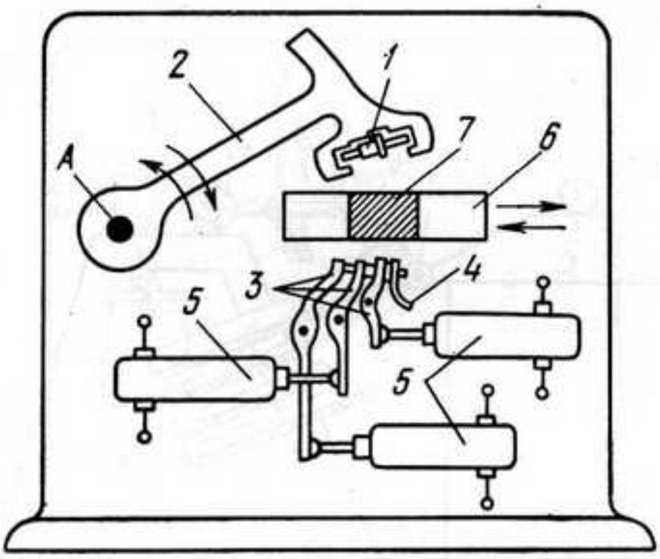
Transporting wheel *5* has an opening in the bottom through which cartridge case *a* can drop by gravity. This opening has pawl *4*, preventing case *a* from dropping through. When a defective case is being inspected, solenoid *1*, energized by a current pulse from an electric-contact measuring facility, (not shown), releases armature *2*. Armature *2*, subject to the action of spring *6*, is connected by a turning and sliding pair to lever *3*, which turns about fixed axis *A* and retracts pawl *4* to one side. At this, case *a* drops through the opening into the reject box. Upon further motion of the transporting wheel, angle members (not shown), rigidly secured to the wheel, press down lever *3* and return armature *2* of solenoid *1* to the initial position.

4527	LEVER-TYPE ELECTROMAGNETIC SORTING MECHANISM	LE SF



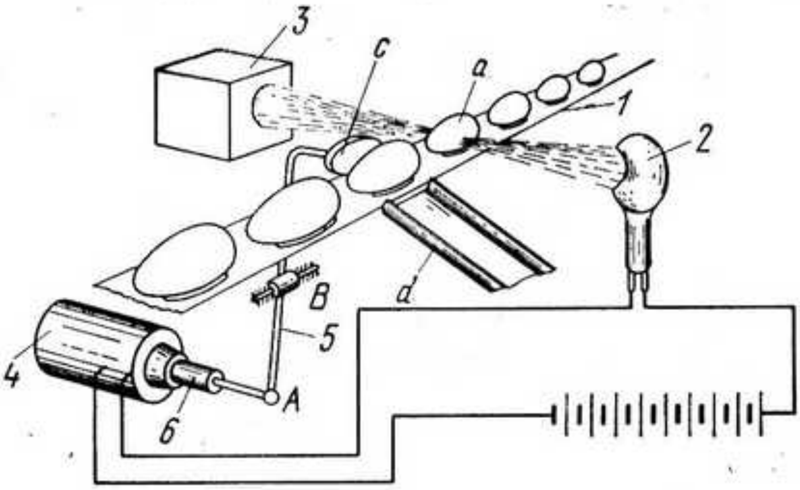
Armature *2* of solenoid *1* is connected by turning pair *C* to link *3*. Link *4* with rigidly attached chute *d* turns about fixed axis *A* and is connected by turning pair *B* to link *3*. Solenoid *1* has four coils (as many as the number of groups into which the workpieces are to be sorted) with different numbers of turns. Depending upon the actual size of a workpiece, the corresponding coil is energized by a current pulse from the electric-contact measuring facility. This pulls in armature *2* a definite distance, correspondingly turning chute *d* in alignment with the chute of the corresponding receiving member. Workpiece *a* rolls down chute *5*, *6*, *7* or *8* to the required sorting box.

4528 | LEVER-TYPE ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION AND SORTING | LE SF



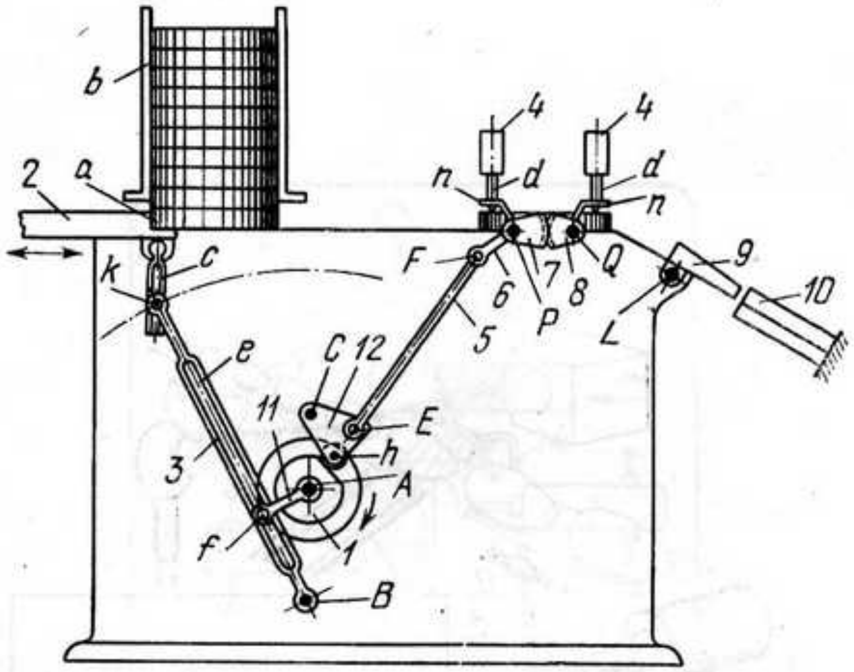
Workpiece *1*, on which three dimensions are to be checked, is delivered from the magazine to a profiled opening of lever *2*. Turning about fixed axis *A*, lever *2* places the workpiece in the inspection position, inserting it between levers *3* and fixed locating member *4*. Levers *3* occupy positions corresponding to the actual lengths of the steps on workpiece *1* and actuate electric-contact measuring facilities *5*. In accordance with the results of inspection, slider *7*, controlled by measuring facilities *5*, is shifted to the right or left. At the end of the checking operation, lever *2* returns to its initial position, carrying workpiece *1* over opening *6* and dropping it into the right or left part of the opening, depending upon the position of slider *7*.

4529	LEVER-TYPE PHOTOELECTRIC EGG TESTING MECHANISM	LE SF



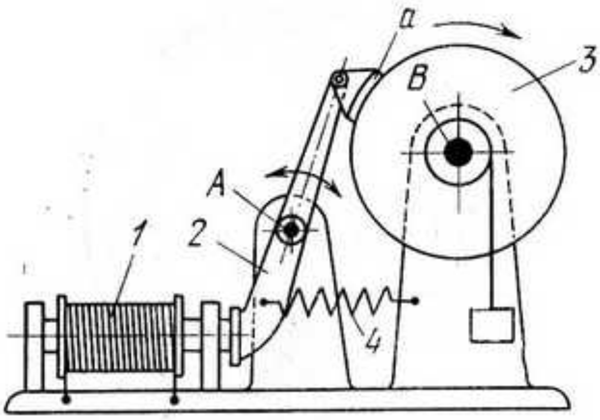
Armature *6* is connected by a turning and sliding pair to the housing of solenoid *4* and by spherical pair *A* to lever *5*, which carries ejecting disk *c* at its other end. Lever *5* is connected by turning pair *B* to the upright. The mechanism is intended for sorting eggs. Each egg *a*, travelling on conveyer *1* past phototube *2*, is illuminated by a beam of light from light source *3*. If the egg is not fresh, its cloudy contents transmits light poorly and solenoid *4*, controlled by pulses from phototube *2*, ejects the egg with disk *c* onto chute *d*.

4530	LEVER-CAM ELECTRIC-CONTACT AUTOMATIC MECHANISM FOR PISTON RING INSPECTION AND SORTING	LE SF



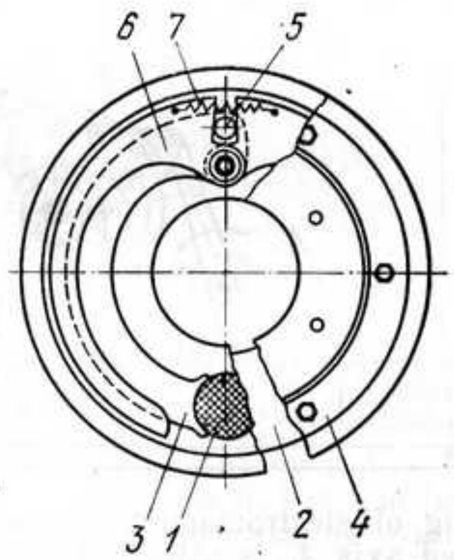
Cam 1 rotates about fixed axis A. Rigidly attached to cam 1 is crank 11, whose pin f slides along slot e of slotted lever 3, which oscillates about fixed axis B. Pin k of lever 3 slides along slot c of carriage 2, which reciprocates horizontally. Follower 12 oscillates about fixed axis C and its roller h rolls along the profile of cam 1. Link 5 is connected by turning pairs E and F to follower 12 and to lever 6, which turns about fixed axis P. Segment gear 7 is rigidly attached to lever 6 and meshes with identical segment gear 8, turning about fixed axis Q. When cam 1 rotates, carriage 2 is reciprocated. In its working stroke, carriage 2 picks up bottom piston ring a from magazine b and carries the ring to the right, under electric-contact measuring facilities 4. Spindles d of these facilities are raised and lowered by levers n rigidly attached to segment gears 7 and 8. As the cycle is repeated, the next ring pushes the inspected ring out of the inspection station and takes its place. In accordance with the height of the ring being inspected, the measuring facility transmits a signal pulse to a device which turns chute 9 about fixed axis L, directing the ring to the corresponding section of sorting hopper 10.

4531	LEVER-TYPE ELECTROMAGNETIC BRAKE MECHANISM	LE Br



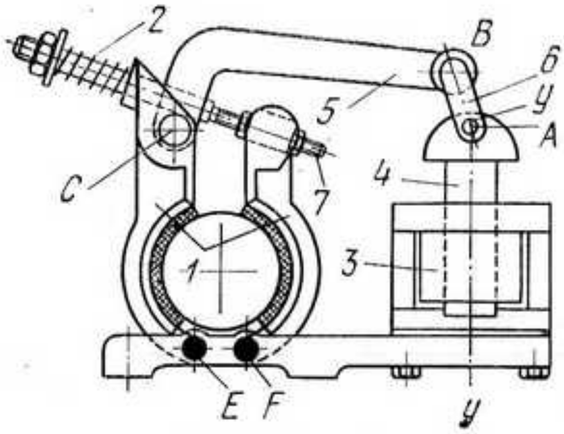
When the winding of electromagnet *1* is energized, lever *2*, turning about fixed axis *A*, is attracted to the electromagnet. Brake shoe *a*, hinged to lever *2*, is pressed against the surface of drum *3*, rotating about fixed axis *B*, to produce the braking effect. When the winding of electromagnet *1* is de-energized, lever *2* is returned by spring *4* to its initial position, retracting brake shoe *a* from drum *3* to release the brake.

4532	LEVER-TYPE ELECTROMAGNETIC BRAKE MECHANISM	LE Br



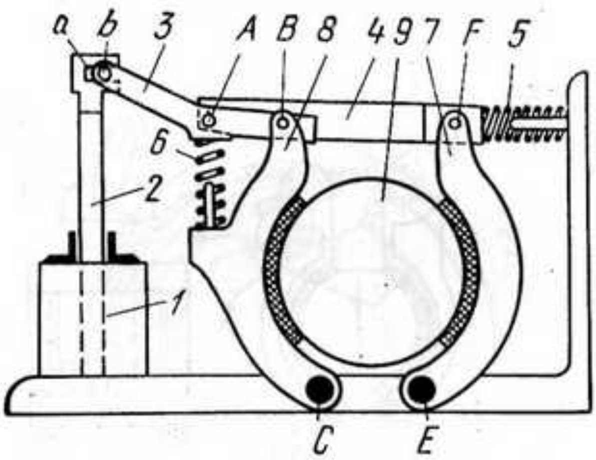
When the winding of electromagnet *1*, mounted rigidly on lever *3*, is energized, lever *3* is attracted to disk *2*, rotating together with drum *4*. Lever *3* rotates in the same direction, displacing pin *5*, which spreads brake shoes *6*, thereby braking drum *4*. When the winding of electromagnet *1* is de-energized, brake shoes *6* are returned to their initial position by spring *7*, releasing the brake.

LEVER-TYPE ELECTROMAGNETIC BRAKE MECHANISM



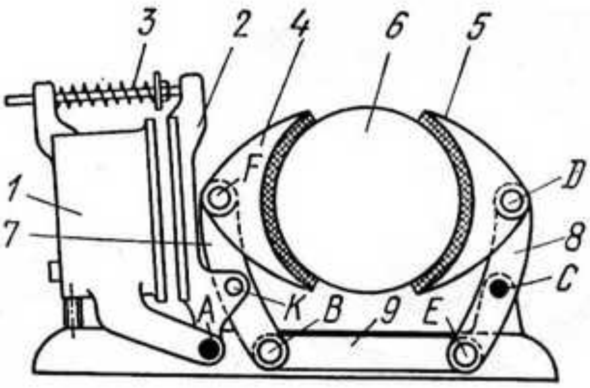
Core *4* can move up and down along axis *y-y* of coil *3*. Link *6* is connected by turning pairs *A* and *B* to core *4* and to lever *5*. Lever *5* is connected by turning pair *C* to left-hand brake shoe *1*, which turns about fixed axis *E*. Right-hand shoe *1*, turning about fixed axis *F*, is clamped against the brake drum by screw device *7* and spring *2*. When coil *3* of the electromagnet is de-energized, spring *2* pulls shoes *1* together against the brake drum and produces the braking effect. When coil *3* is energized, core *4* is pulled into the coil, turning lever *5* so that it spreads shoes *1* and releases the brake.

LEVER-TYPE ELECTROMAGNETIC BRAKE MECHANISM



Core *2* of solenoid *1* has slot *a* along which pin *b* of lever *3* slides. Lever *3* is connected by turning pairs *A* and *B* to lever *4* and to brake shoe *8*, which turns about fixed axis *C*. Shoe *7* turns about fixed axis *E* and is connected by turning pair *F* to lever *4*. When the winding of solenoid *1* is energized, core *2* is pulled into the solenoid and lever *3* is pulled downward, displacing lever *4* to the right so that it overcomes the resistance of spring *5* and retracts right-hand shoe *7* from brake drum *9*. As it continues to move downward, lever *3* overcomes the resistance of spring *6* and retracts left-hand shoe *8*. This releases the brake. When the winding of solenoid *1* is de-energized, levers *3* and *4*, actuated by springs *5* and *6*, force shoes *7* and *8* against drum *9*, producing the braking effect.

LEVER-TYPE ELECTROMAGNETIC BRAKE MECHANISM

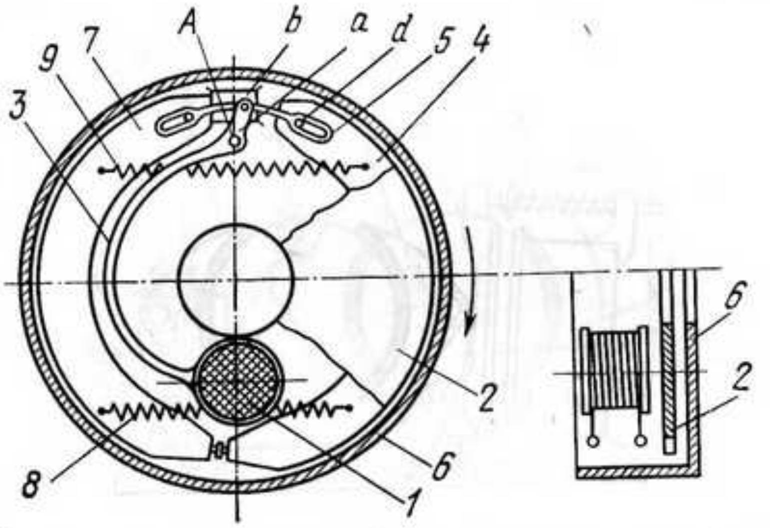


Armature 2 of electromagnet 1 turns about fixed axis A and is connected by turning pair K to lever 7, which, in turn, is connected by turning pair F to left-hand brake shoe 4. Link 9 is connected by turning pairs B and E to lever 7 and to lever 8, which turns about fixed axis C. Right-hand brake shoe 5 is connected by turning pair D to lever 8. When the winding of electromagnet 1 is energized, armature 2 is attracted to the electromagnet, overcoming the resistance of spring 3. This spreads brake shoes 4 and 5, and the brake is released. When the winding of electromagnet 1 is de-energized, armature 2 is pushed to the right by spring 3, and shoes 4 and 5 are forced against brake drum 6, producing the braking effect.

4536

LEVER-TYPE ELECTROMAGNETIC BRAKE MECHANISM

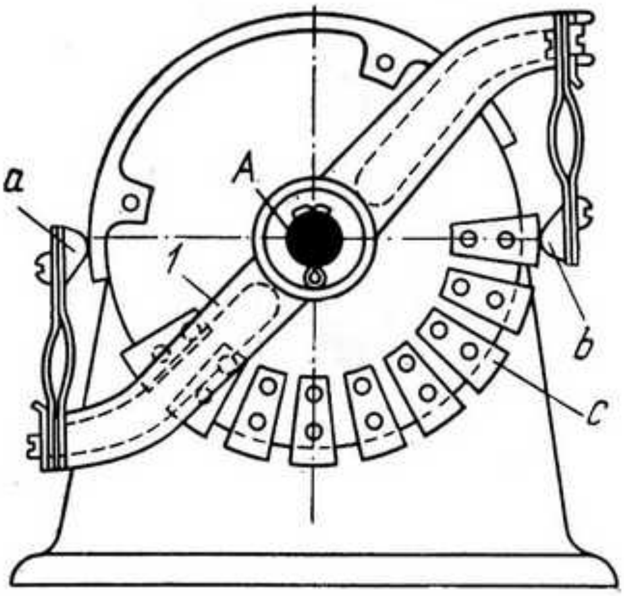
LE
Br



When the winding of electromagnet *1* is energized, the electromagnet attracts rotating disk *2* and begins to turn in the same direction. This turns lever *3* about axis *A* so that its lug *a* actuates pin *d* of shoe *4*, by means of link *5*, pressing the brake shoes, *4* and *7*, against the inside surface of brake drum *6*. At this, shoe *7* bears against a bracket in the body of the brake. Upon rotation in the opposite direction, the roles played by shoes *4* and *7* are interchanged. When the winding is de-energized, the shoes are retracted by springs *8* and *9*, thereby releasing the brake.

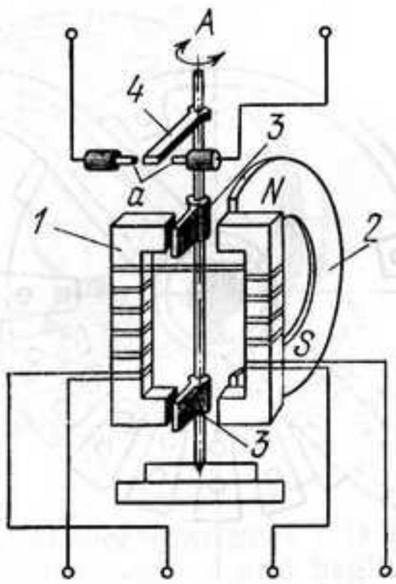
8. SWITCHING, ENGAGING AND DISENGAGING MECHANISMS (4537 through 4560)

4537	LEVER-TYPE CYLINDRICAL RHEOSTAT-STEP SWITCHING MECHANISM	LE SE



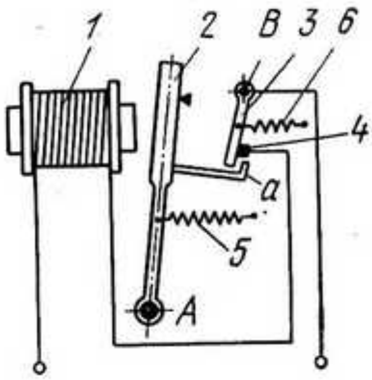
When lever *1* is turned about fixed axis *A*, movable contacts *a* and *b* are set to the required fixed contact *c*, thereby switching over the steps of the rheostat.

4538	LEVER-TYPE POLARIZED ELECTROMAGNET MECHANISM	LE SE



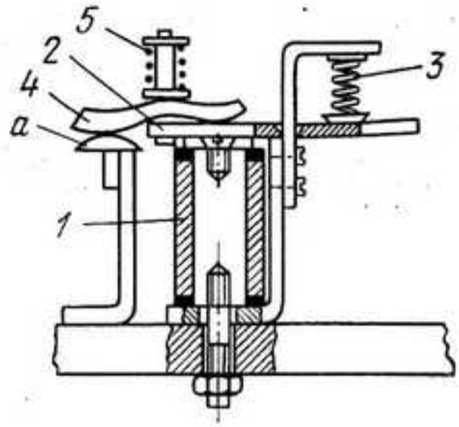
When the direction of the electric current in one of the windings of electromagnet *1* is such that it sets up a magnetic field that strengthens the field of permanent magnet *2*, armature *3* is deflected. Turning about fixed axis *A*, armature *3* turns lever *4* so that it closes an electric circuit at one of contacts *a*. If the other winding is energized, the field of magnet *2* is weakened, and lever *4* closes another circuit at the other contact *a*.

4539	**LEVER-TYPE AUTOMATIC CURRENT INTERRUPTER MECHANISM**	**LE** **SE**



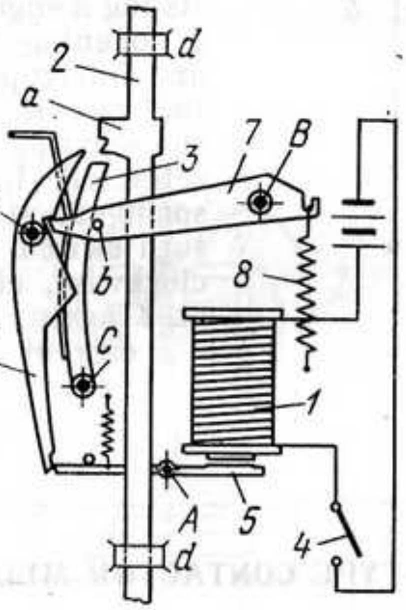
Armature *2* and switch member *3* turn about fixed axes *A* and *B*. When the winding of electromagnet *1* is energized, armature *2* is attracted to the core of the electromagnet and its lug *a* engages switch member *3*, opening the contacts at *4* and interrupting the current in the circuit. This de-energizes the winding and armature *2* is retracted from the core by spring *5*, allowing spring *6* to turn switch member *3* counterclockwise, closing the contacts at *4* again, so that there is a current in the circuit.

4540	**LEVER-TYPE CONTACTOR MECHANISM**	**LE** **SE**



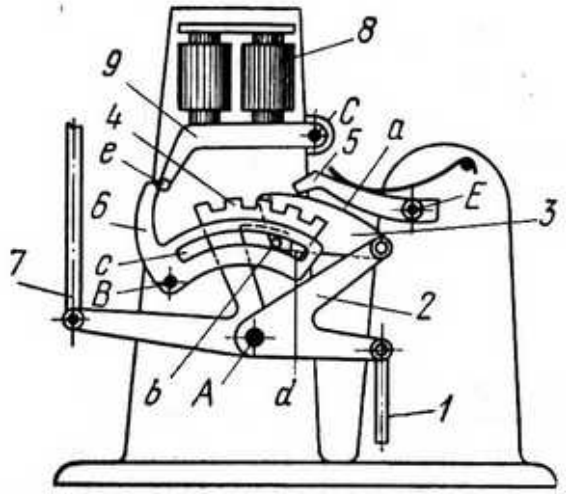
When the winding of electromagnet *1* is energized, armature *2* is attracted to the core of the electromagnet. At this, member *4*, in contact with armature *2*, is forced by spring *5* to close the contacts at *a*. When the winding is de-energized, spring *3* retracts armature *2*, opening the contacts at *a*.

4541	LEVER-RATCHET ELECTROMAGNETIC CUTOUT MECHANISM	LE SE



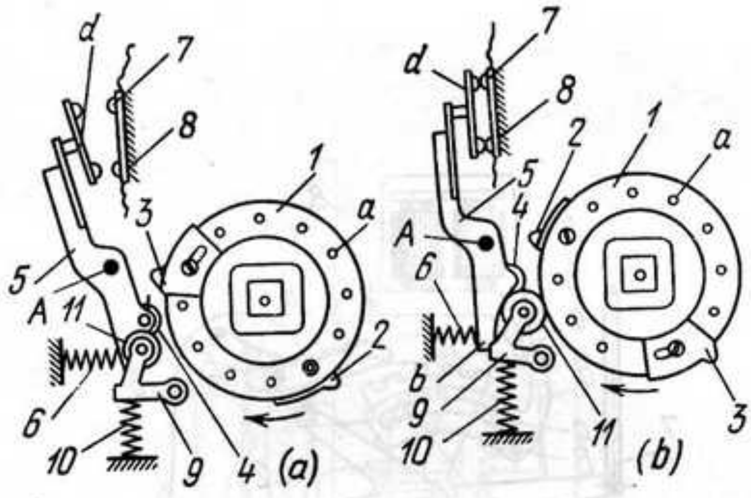
Rod *2* can slide up or down in fixed guides *d-d*. Armature *5* of electromagnet *1* turns about fixed axis *A*. Levers *7*, *3* and *6* turn about fixed axes *B*, *C* and *D*. When the winding of electromagnet *1* is de-energized, lug *a* on rod *2* engages lever *3*, keeping rod *2* from moving downward. When the winding of electromagnet *1* is energized by closing switch *4*, one end of armature *5* is attracted to the electromagnet. The other end of armature *5* moves downward and releases lever *6*, which turns counterclockwise, releasing the left end of lever *7*. Spring *8* turns lever *7* clockwise and its pin *b* retracts lever *3* from lug *a*, allowing rod *2* to move down freely.

4542 | **LEVER-RATCHET CLUTCH-GEAR MECHANISM WITH AN ELECTROMAGNETIC CUTOUT** | LE SE



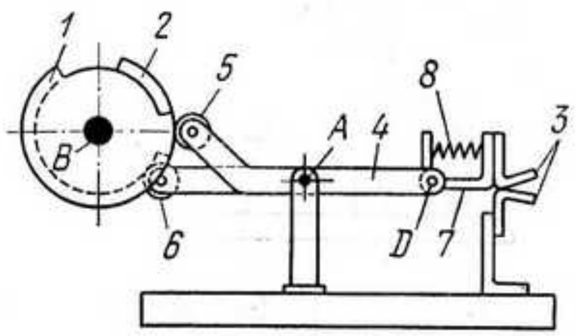
Toothed segment *4* turns about fixed axis *A*. Levers *6* and *9* turn about fixed axes *B* and *C*. Pawl *5* turns about fixed axis *E*. When tie-rod *1* moves downward, angle lever *2* turns clockwise about axis *A*. At this, upper edge *a* of link *3* disengages pawl *5* from toothed segment *4*, and pin *b* of link *3*, sliding along slot *c* of lever *6*, engages lug *d* of toothed segment *4*. This turns segment *4* and pulls tie-rod *7*, connected to the segment by a turning pair. Motion is transmitted from tie-rod *1* to tie-rod *7* only when the coils of electromagnet *8* are energized, because in this case, lever *9* is attracted by the electromagnet and its lug *e* holds lever *6*. When the coils of electromagnet *8* are de-energized, lever *9* drops downward and lever *6* is turned clockwise by pin *b* so that edge *a* of link *3* passes under pawl *5* without disengaging it from toothed segment *4*. Consequently, upon motion of tie-rod *1*, tie-rod *7* remains stationary.

4543	CAM-LEVER CIRCUIT BREAKER MECHANISM	LE SE



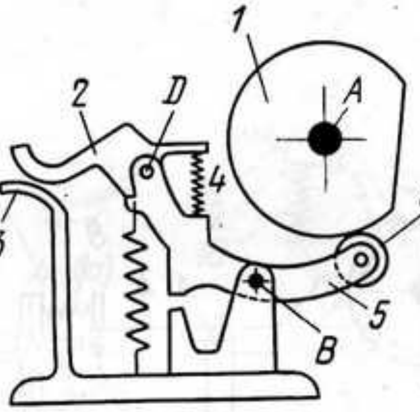
Secured in holes *a*, located in a circle around the circumference of disk *1*, are switching-on cam-dog *2* and switching-off cam-dog *3*. Cam-dogs *2* and *3* are in different planes and can be installed along the circumference at different holes *a*. As disk *1* rotates clockwise, switching-on cam-dog *2* (Fig. *a*) runs up against roller *4*. At this, lever *5*, overcoming the resistance of spring *6*, turns clockwise about fixed axis *A*, closing contacts *7* and *8* by means of bridge member *d*, mounted on lever *5* (Fig. *b*). Upon further rotation of disk *1*, cam-dog *2* runs off roller *4*, but contacts *7* and *8* remain closed. This is accomplished by having latch *9* bear against lug *b* of lever *5* (when contacts *7* and *8* are closed) due to the action of spring *10*. Thus latch *9* keeps lever *5* from turning counterclockwise and opening contacts *7* and *8* (Fig. *b*). Contacts *7* and *8* remain closed until, upon further rotation of disk *1*, switching-off cam-dog *3* reaches roller *11*, mounted on latch *9*, and forces latch *9* downward, overcoming the resistance of spring *10*. This releases lug *b* of lever *5* which is turned counterclockwise by spring *16*, opening contacts *7* and *8*. Rollers *4* and *11* are located in the planes of cam-dogs *2* and *3*, respectively. By installing cam-dogs *2* and *3* at various points along the hole circle of disk *1*, contacts *7* and *8* can be opened and closed at specified angles of rotation of the circuit breaker.

4544	CAM-LEVER ON-OFF SWITCHING MECHANISM	LE SE



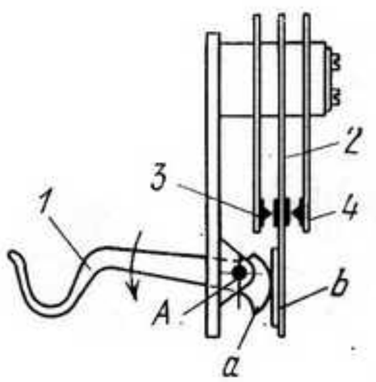
Cams *1* and *2*, rigidly attached to each other, rotate about fixed axis *B*. Follower *4*, having rollers *5* and *6*, turns about fixed axis *A* and is connected by turning pair *D* to bent contact member *7*, actuated by spring *8*. Contacts *3* are opened and closed by cams *1* and *2*. The provision of two rollers (*5* and *6*), holds them in contact with the cams and prevents indefinite motion.

4545	CAM-LEVER CONTROLLER MECHANISM	LE SE

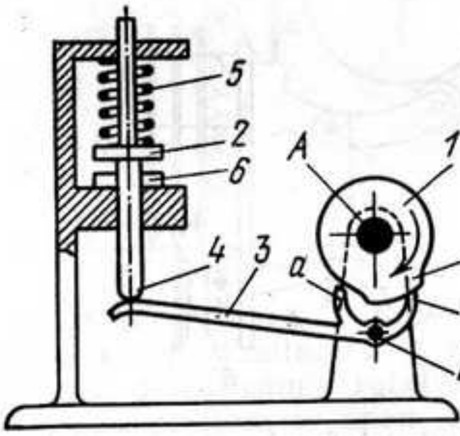


Cam 1 rotates about fixed axis A. Follower 5, carrying roller 6, turns about fixed axis B. Contact 2 is connected by turning pair D to follower 5. When cam 1 rotates, moving and stationary contacts, 2 and 3, close or open. Contacts 2 and 3 are of rolling lever shape: initial and final contact occur at different points along the surfaces of contact. This provides good protection of the surfaces against burning and oxidation, and the sliding friction between the surfaces removes the oxide films and improves the contacting properties. The springs hold the contact surfaces together, and also hold roller 6 against cam 1.

4546	CAM-LEVER TELEPHONE SWITCH MECHANISM	LE SE

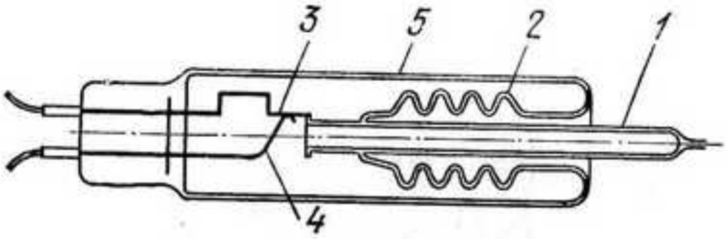


Hook (lever) *1* turns about fixed axis *A* and has shaped end *a*, which slides along strip *b* of elastic member *2*. When the telephone receiver is hung on hook *1*, the hook is turned counterclockwise and its shaped end *a* retracts strip *2*, opening the contacts at *3* and closing the contacts at *4*.



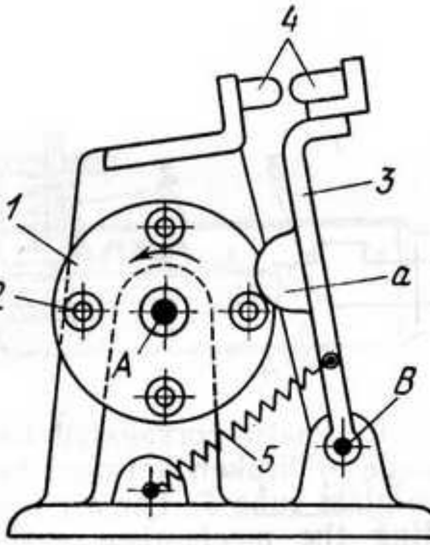
Cam *1* rotates about fixed axis *A*. Lever *3* turns about fixed axis *B* and has two lugs *a* that slide along the contoured surface of cam *1*. As cam *1* rotates, its lobe *d* turns lever *3* and opens the contacts, lifting plate *2* by means of rod *4*. The contacts are closed by spring *5*, which forces plate *2* against the terminals of contact *6*.

4548 | LEVER-TYPE VACUUM SWITCH MECHANISM | LE SE



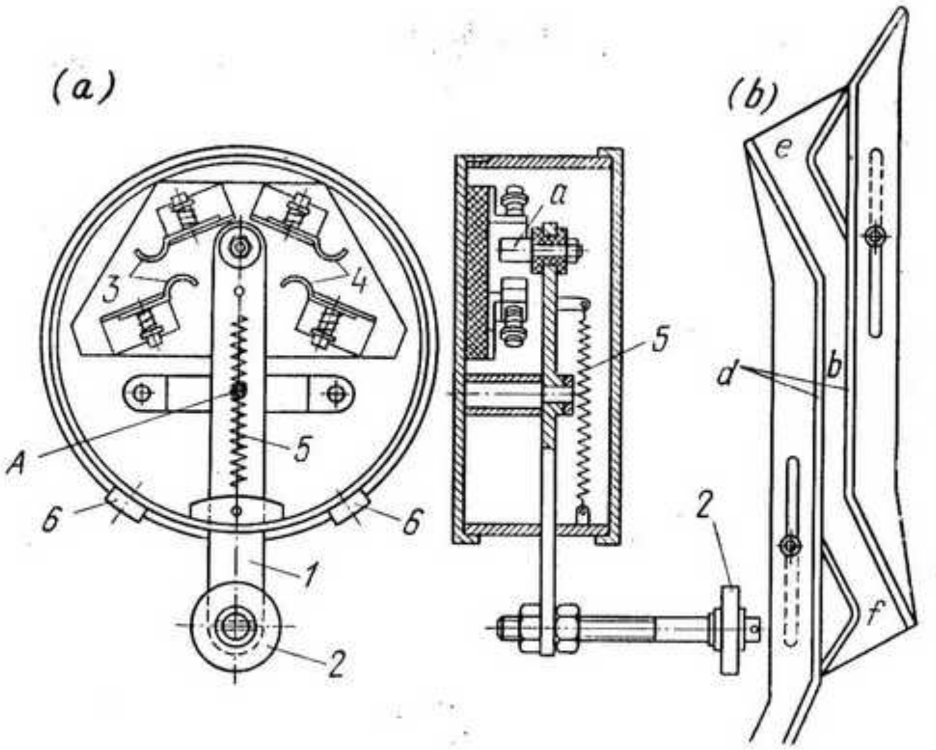
When rod *1*, joined to elastic corrugated tube *2*, is displaced, contact is either made or broken between two contact springs, *3* and *4*, sealed into glass tube *5*. The air has been pumped out of tube *5*, providing the mechanism with high sensitivity.

4549 **LEVER-TYPE CURRENT INTERRUPTER MECHANISM** LE SE



When disk *1*, on which rollers *2* are mounted, rotates about fixed axis *A*, the rollers run up against lug *a* of lever *3*, which turns about fixed axis *B*. This opens contacts *4*. Contacts *4* are closed by spring *5*. The frequency with which the contacts are opened and closed can be regulated by varying the speed of rotation of disk *1* or the number of rollers *2* installed on disk *1*.

4550	LEVER-TYPE LIFT FLOOR-SELECTION SWITCH MECHANISM	LE SE



One floor switch is installed at each floor in the lift shaft for automatically stopping the lift cage at the required floor. Switch lever *1*, on whose upper end pin *a* is mounted and which carries roller *2* at its lower end, can be in various positions, being turned about fixed axis *A* by the action of the shifting member (Fig. *b*), secured on the cage, on roller *2*. As the cage approaches the required floor, roller *2* slides between guides *d* of the shifting member (Fig. *b*). When the cage is at the level of the floor, roller *2* is in its middle position *b*, owing to which switch lever *1* is in its middle, vertical position. At this, contacts *3* and *4* are open. If the cage begins to move upward, roller *2*, as it leaves the shifting member, is turned by guides *d* to position *f*, turning lever *1* clockwise so that pin *a* closes contacts *4*. Shifting together with lever *1* is the upper end of spring *5*, whose lower end is secured to the switch housing. Even though roller *2* leaves the shifting member upon further motion of the cage, spring *5* holds lever *1* in the turned position, closing contacts *4*. If the cage begins to move downward, roller *2* of lever *1* is deflected by guides *d* of the shifting member to position *e*, turning lever *1* counterclockwise so that pin *a* closes contacts *3*. When roller *2* leaves the shifting member, spring *5* holds lever *1* in the turned position, closing contacts *3*. Stops *6* limit the extreme positions of lever *1*. Thus, lever *1* of the floor switch, at the floor where the lift cage is, is in the middle

position. Rollers *2* of the levers of the switches above this floor are in their right-hand position, so that pin *a* closes contacts *3*. Rollers *2* of the switches at the floors below the cage are in the left-hand position, in which contacts *4* are closed. By pressing a button, the passenger in the lift cage connects the floor switch at the required floor into the control circuit. When the rising lift cabin approaches the specified floor, roller *2* of the corresponding floor switch is shifted from the right-hand to the middle position, opening the control circuit and stopping the cage. As the cage passes other floors, the roller at each floor whose switch is not switched into the control circuit is shifted to the left-hand position. The lift cage descends in a similar manner, except that the rollers of all the floor switches, not including the one at the floor where the lift is to stop, are shifted from the left-hand to the right-hand positions by the shifting member.

4551 LEVER-TYPE SOLENOID OIL SWITCH MECHANISM

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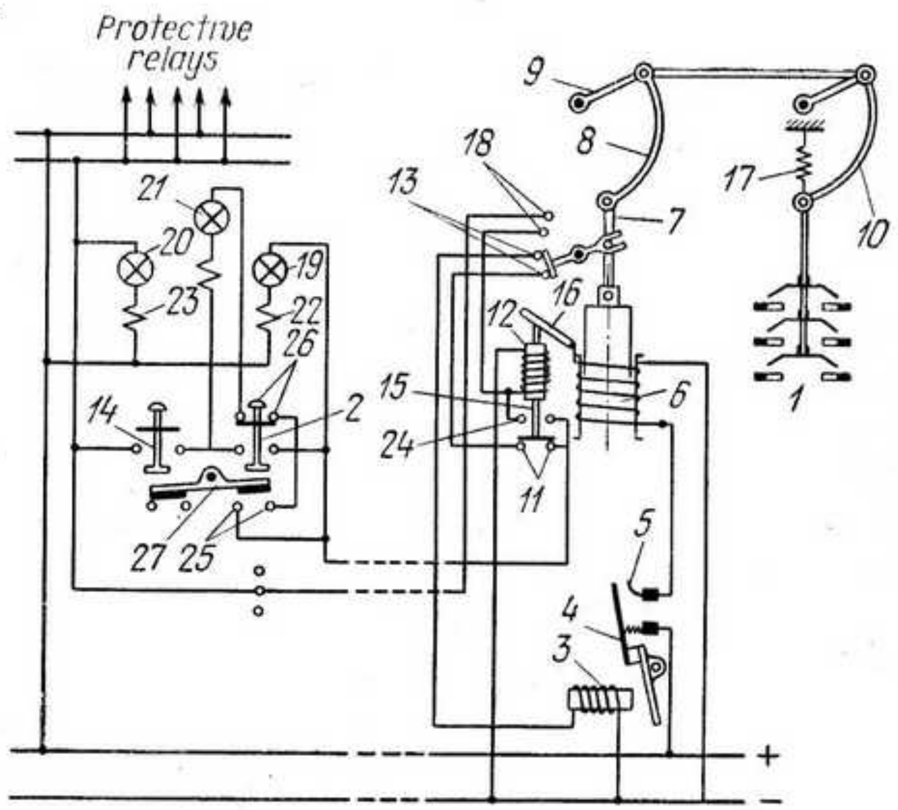
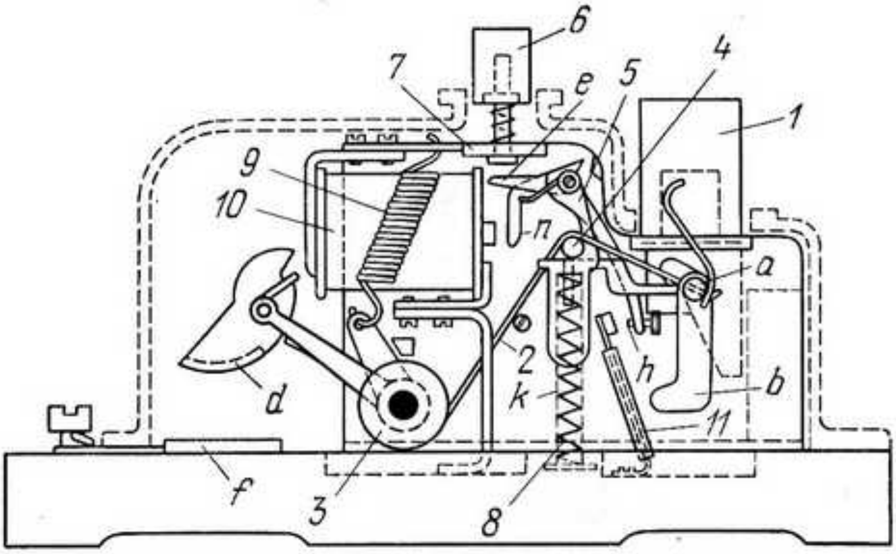


The mechanism is intended for closing and opening oil switch *1*. When the winding of coil *3* of the auxiliary relay is energized by pressing the pushbutton of switch *2*, armature *4* of the relay closes the contacts at *5* of the circuit supplying closing solenoid *6*. When this solenoid is energized, its armature *7* is pulled in and, by means of rods *8*, *9* and *10*, closes switch *1*. To close the circuit of coil *3*, two pairs of interlocking contacts must be closed: contacts *11* of opening solenoid *12* and signal lamp contacts *13* of switch *1*. Switch *1* can be opened either by pressing the pushbutton of switch *14* or by the contacts of one of the protective relays (not shown). In opening switch *1* by means of switch *14*, the coil winding of opening solenoid *12* is energized, its armature *15* is pulled in and it retracts latch *16*. Then rod *7* is raised by spring *17*, and switch *1* is opened by means of rods *8*, *9* and *10*. To close the circuit of the coil of opening solenoid *12*, switch *1* must be closed. This is checked by including signal lamp contacts *18* into this circuit. The operation of the switch actuating drive is continually controlled by signal lamps *19*, *20* and *21* (green, red and yellow). The circuits of signal lamps *19* and *20* include, respectively, the circuit of auxiliary relay *3* and that of opening solenoid *12*. The lamps are supplied through added resistors *22* and *23*, and are selected

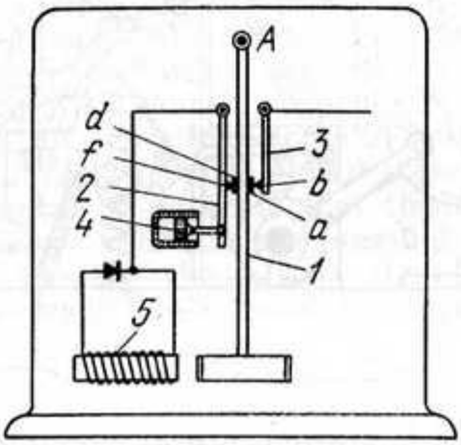
so that the current required to light the lamp is considerably less than that required to trip relays *3* and *12*, and also less than the releasing current. The conditions for the lighting of lamp *19* are the closed state of auxiliary contacts *13*, which are closed when switch *1* is open, and the closed state of contacts *11*, which are closed when opening solenoid *12* is not energized. The necessary condition for the lighting of lamp *20* is the closed state of contacts *18*, which are closed when switch *1* is closed. The third (emergency) signal lamp *21* lights up upon automatic opening of switch *1* by a protective device. The condition for forming the circuit of lamp *21* is the closed state of contacts *11*, *13*, *25* and *26*. The closed state of contacts *25* of toggle switch member *27* indicate that the last manual operation performed before this was the pressing of the pushbutton of switch *2*. The purpose of auxiliary signal lamp contacts *13* and *18* is to de-energize coils *3* and *12* after their operation is no longer necessary, and, at the same time, to close the signal lamp circuits. Contacts *11* and *24* eliminate the possibility of oscillation of oil switch *1* when it operates on an emergency line. If the pushbutton of switch *2* is held down too long, opening solenoid *12* is energized through contacts *24*, while the circuit of auxiliary relay *3* is broken at contacts *11*.

4552	KUROVSKY LEVER-TYPE ELECTRIC PUSHBUTTON SWITCH MECHANISM	LE SE



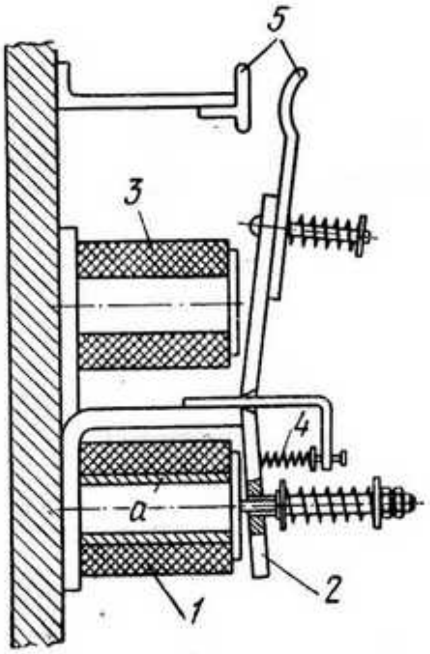
When pushbutton *1* is pressed, pin *a*, mounted on the pushbutton, slides along slot *b* of the housing and, by means of metal band *2*, turns driven shaft *3* counterclockwise. At this, moving contact *d*, mounted on shaft *3*, touches stationary contact *f*. Metal band *2* runs over pin *4*, which is held by detent lever *5*. When switch opening pushbutton *6* is pressed, lever *7* engages lug *e* of lever *5* which detains pin *4*. As pin *4* is freed, it is moved downward by spring *8* along slot *k* of the housing. At this, driven shaft *3* is turned clockwise by spring *9*, opening contacts *d* and *f*. Lever *5* can also be disengaged from pin *4* by de-energizing the coil of electromagnet *10*, which, when energized, attracts lug *n* of lever *5*. Automatic emergency switching off may be accomplished by bimetallic strip relay *11*. Bimetallic strip *11* is heated by a winding surrounding the strip and this depends upon the current of the switch contacts. At a current exceeding the preset value, bimetallic strip *11* is bent and bears against lug *h* of lever *5*, disengaging the lever from pin *4*.

4553	PENDULUM-TYPE SYNCHRONOUS CONTACTING MECHANISM	LE SE

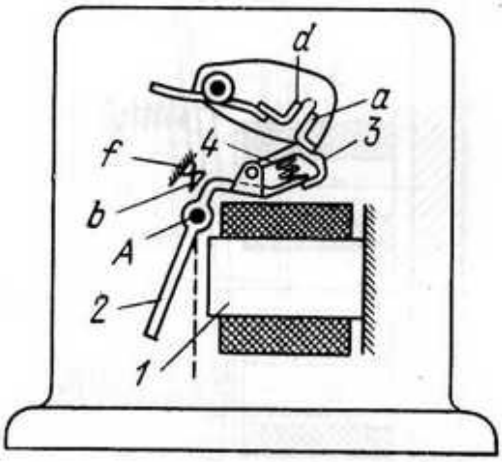


When coil *5*, loaded by receiver *4*, is periodically energized, the coil begins to swing armature *1*, which is a pendulum oscillating about fixed axis *A*, by means of contacts *2*, *f*, *d*, *a* and *b*. If the period of energizing and de-energizing of coil *5* coincides with the natural period of armature *1*, then the amplitude of the armature increases to a point where it closes the contacts at *3*.

4554 **LEVER-TYPE TIMING CONTACTOR MECHANISM** LE SE

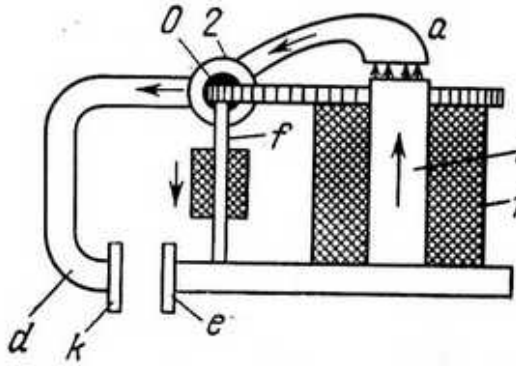


When coil *1* is energized, armature *2* is attracted to its core. Owing to the provision of damping sleeve *a*, the magnetic flux decreases slowly when coil *1* is de-energized and, when the flux reaches a low enough value, armature *2* is released and is retracted by spring *4*. At this time, coil *3* is energized and its core attracts armature *2*, closing contacts *5*.



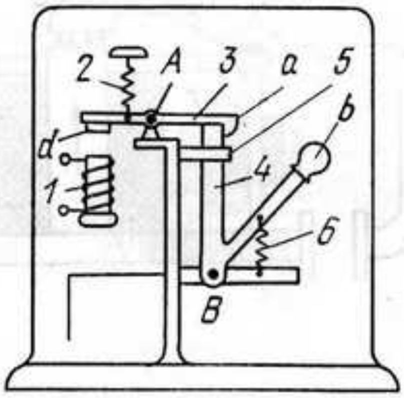
The contactor is a switch actuated by an electromagnet. When the winding of electromagnet *1* is energized, armature *2*, turning about fixed axis *A*, is attracted to the core of electromagnet *1* and, by means of lever *3*, closes contacts *a* and *d*. Arranged between lever *3* and armature *2* is compressed spring *4*, which provides tight, reliable closing of contacts *a* and *d*. Interlock contacts *b* and *f* are also closed when main contacts *a* and *d* are closed.

4556	LEVER-TYPE SERIES CONTACTOR MECHANISM	LE SE



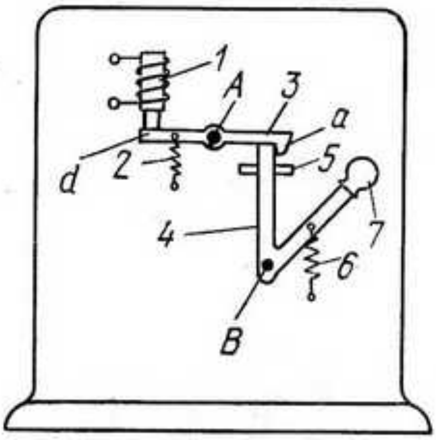
When the winding of electromagnet *1* is energized, armature *2*, consisting of two parts, *a* and *d*, rigidly attached together, turns about fixed axis *O*. The magnetic flux from main core *b* is through armature *a* where it divides into two, one part through magnetic circuit *d* and the other through magnetic circuit *f*. Then the two magnetic fluxes join together again. Armature *2* of the contactor is subject to two forces of attraction: a force that tends to turn armature *2* counterclockwise and close contacts *k* and *e*, and a force that tends to turn armature *2* clockwise and opposing the closing of contacts *k* and *e*. The ratio of these forces can be varied by changing the cross section of magnetic circuit *f* to obtain the closing of contacts *k* and *e* at a definite value of the current in the winding of electromagnet *1*.

4557 **LEVER-TYPE MAXIMUM BREAKER MECHANISM** LE SE



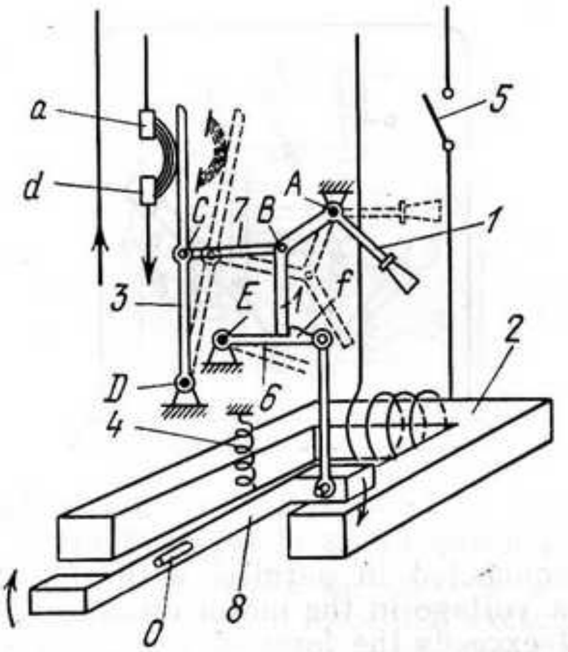
This circuit breaker is used to protect a circuit against overloads and short circuits. While the current is within the permissible value, spring *2* exerts a force that exceeds the attractive force of electromagnet *1*, and lug *a* of lever *3*, turning about fixed axis *A*, retains lever *4*. Lever *4* turns about fixed axis *B* and is held in the position in which the contacts at *5*, energizing electromagnet *1*, are closed. When the current exceeds the permissible value, the attraction of electromagnet *1* exceeds the tension of spring *2* and armature *d*, mounted on lever *3*, is attracted to the core of electromagnet *1*, releasing lever *4*. Lever *4* is turned by spring *6* to open the contacts at *5*. The contacts at *5* are closed manually by lever *b*, rigidly attached to lever *4*.

4558 LEVER-TYPE NO-VOLTAGE BREAKER MECHANISM LE SE



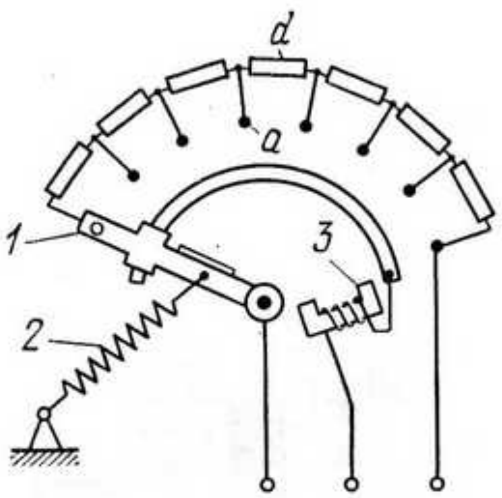
The left-hand arm of lever *3*, turning about fixed axis *A*, is subject to the opposing forces of spring *2* and electromagnet *1* whose coil is connected in parallel with the electric motor. While there is a voltage in the motor circuit, the attraction of electromagnet *1* exceeds the force of spring *2* and armature *d*, mounted at the left end of lever *3*, is attracted to the core of electromagnet *1*. At this, lug *a* of lever *3* retains lever *4*, turning about fixed axis *B*, in the position in which the contacts at *5* are closed. Upon a voltage drop in the mains, spring *2* retracts the left-hand arm of lever *3* so that lug *a* releases lever *4*. Lever *4* is turned by spring *6* to open the contacts at *5*, disconnecting the electric motor from the power mains. The contacts at *5* are closed manually by turning lever *7*, rigidly attached to lever *4*.

4559	LINKWORK ELECTROMAGNETIC CUTOUT MECHANISM	LE SE



Lever *1*, turning about fixed axis *A*, engages lug *f* of lever *6*, turning about fixed axis *E*. Link *7* is connected by turning pairs *B* and *C* to lever *1* and to lever *3*, turning about fixed axis *D*. Contacts *a* and *d* cannot be opened manually with lever *1* while the winding of electromagnet *2* is de-energized. When the winding of electromagnet *2* is energized by closing switch *5*, armature *8* turns about axis *O*, overcoming the resistance of spring *4*. This turns lever *6* clockwise, releasing linkwork *ABCD* for closing contacts *a* and *d*. Then, when lever *1* is turned to the position shown by dash lines, contacts *a* and *d* are opened.

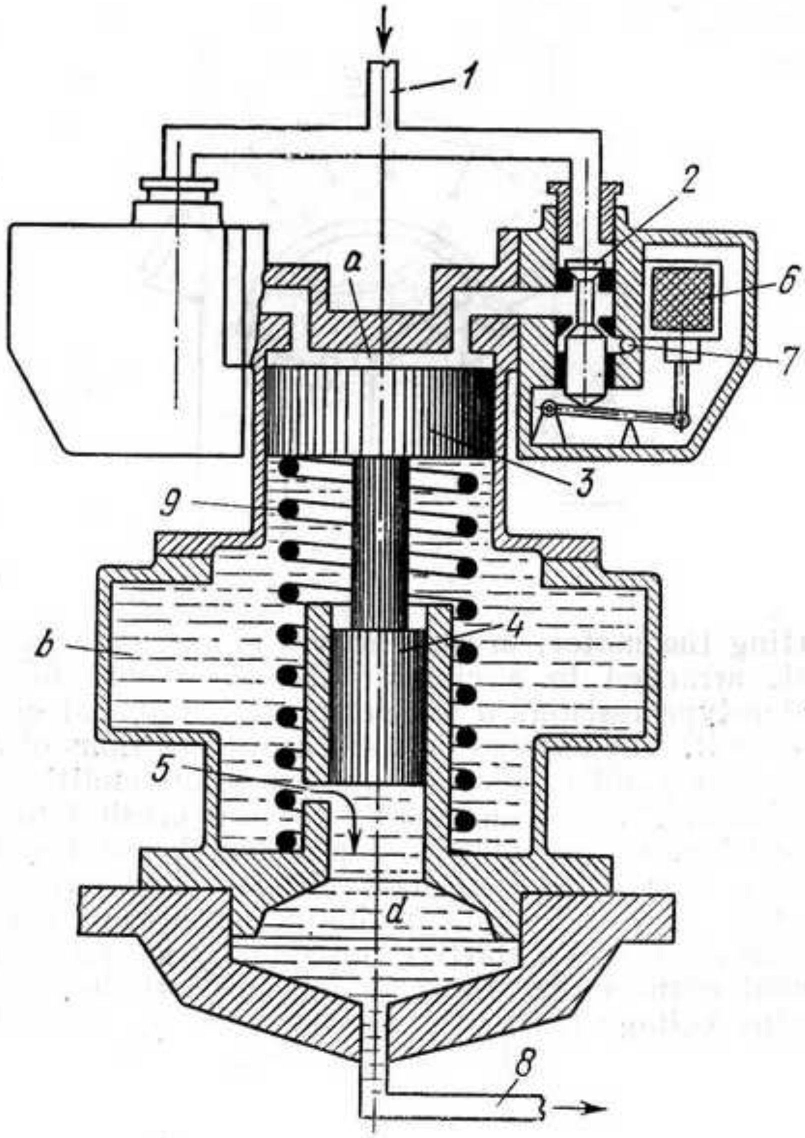
4560	LEVER-TYPE STARTING RHEOSTAT MECHANISM FOR A D-C SHUNT-WOUND MOTOR	LE SE



In starting the motor, brush *1* moves along contacts *a* of the rheostat, arranged in a circular arc. Connected to contacts *a* are step-type resistors *d* which are gradually cut out of the motor circuit. The extreme left and right positions of rheostat brush *1* correspond to the idle and working conditions of the motor. Spring *2* tends continually to turn brush *1* to its left-hand position. In its right-hand position, brush *1* is held by electromagnet coil *3*, connected into the field circuit of the motor. Upon a voltage drop in the mains, brush *1* is automatically returned to its starting position by spring *2*. This arrangement ensures that the motor is not switched on to the full mains voltage (with the starting resistors cut out) when voltage is restored.

9. MECHANISMS OF OTHER FUNCTIONAL DEVICES
(4561 through 4573)

4561	LEVER-TYPE PNEUMOHYDRAULIC PUMP MECHANISM FOR A WELDING MACHINE	LE FD



4561

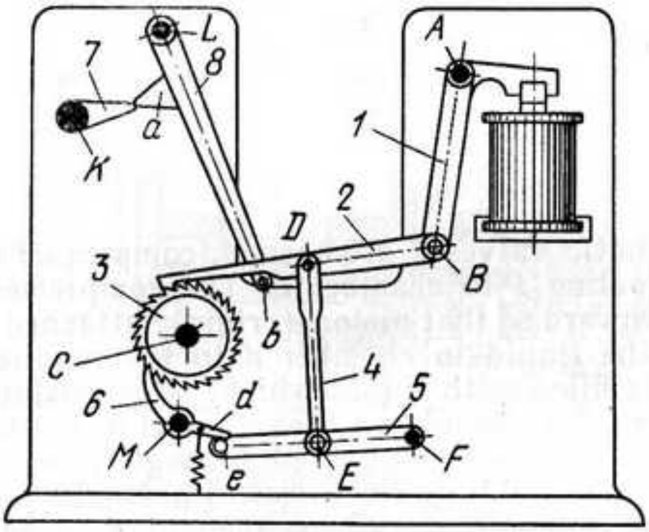
LEVER-TYPE PNEUMOHYDRAULIC PUMP MECHANISM FOR A WELDING MACHINE

LE

FD

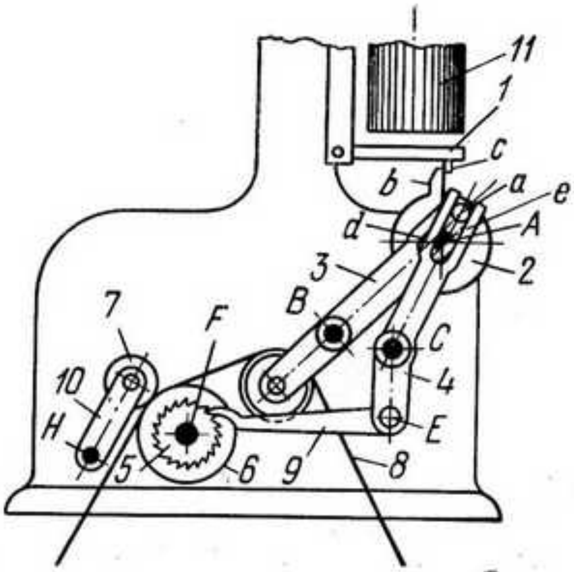
When pneumatic valves *2* are opened, compressed air is delivered by pipeline *1* to chamber *a*. The compressed air forces piston *3* downward so that piston *4*, rigidly attached to piston *3*, compresses the liquid in chamber *d* to the required pressure. Chamber *b* is filled with liquid which, when piston *4* is in its upper position, fills chamber *d* through port *5*. From chamber *d*, liquid under pressure is delivered through pipeline *8* to the cylinders of the welding electrodes. Pneumatic valves *2* are controlled by solenoid *6*. When solenoid *6* is energized, its armature is pulled in and the spools of valves *2* are in their upper position, in which compressed air is delivered to chamber *a* of the pneumatic cylinder. At the end of the welding operation, solenoid *6* is de-energized. At this, the spools of valves 2 shift downward, cutting off air delivery to chamber *a*. At the same time, the passage is opened for releasing air from the pneumatic chamber to the atmosphere through port *7*. When the pressure drops in chamber *a*, spring *9* returns the pistons to the initial position.

4562	LEVER-RATCHET CARRIAGE MECHANISM FOR TELEGRAPH APPARATUS	LE FD



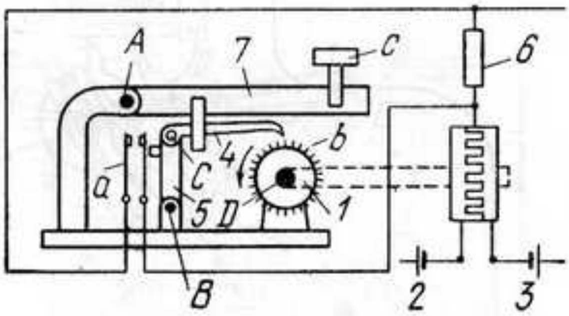
Lever *1* turns about fixed axis A. Pawl *2* engages ratchet wheel *3*, which rotates about fixed axis C, and is connected by turning pairs B and D to lever *1* and to link *4*. Lever *5* turns about fixed axis F and is connected by turning pair E to link *4*. Lug *7* rotates about fixed axis K and engages lug a of lever *8*, which turns about fixed axis L and has pin b at its end. Locking pawl *6* turns about fixed axis M, engages the teeth of ratchet wheel *3* and engages pin e of lever *5* with its lug d. When the electromagnet is energized, attracting lever *1* with its armature, pawl *2* first moves to the left and then to the right, engaging ratchet wheel *3* and turning it clockwise through one tooth. As lug *7* rotates about axis K, it pushes lever *8* to the right so that its pin b disengages pawl *2* from ratchet wheel *3*, and, through link *4* and lever *5* with pin e, also disengages locking pawl *6* from the ratchet wheel.

4563	LEVER-RATCHET TAPE TRANSPORT MECHANISM	LE FD



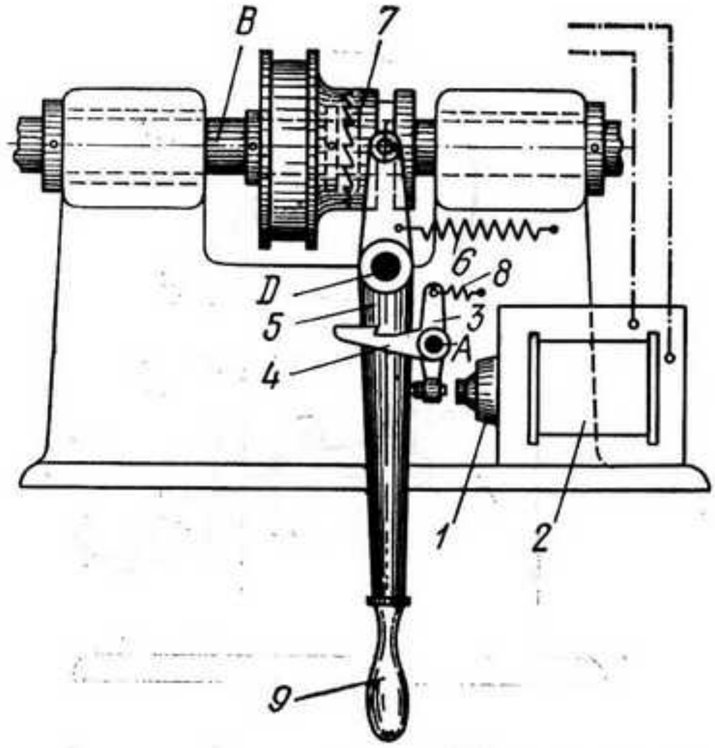
Disk *2* rotates about fixed axis *A* and its tooth *b* engages lug *c* of lever *1*. Disk *2* has pin *a* which slides in slots *d* and *e* of levers *3* and *4*. Levers *3* and *4* turn about fixed axes *B* and *C*. Pawl *9* engages ratchet wheel *5*, rotating about fixed axis *F*, and is connected by turning pair *E* to lever *4*. Roll *7* is mounted on lever *10*, which turns about fixed axis *H*. When lever *1* is attracted by electromagnet *11*, disk *2* makes one full revolution, actuating levers *3* and *4* and pawl *9* by means of pin *a*. Pawl *9* turns ratchet wheel *5* together with roll *6*, rigidly attached to the ratchet wheel, transporting tape *8*, clamped between rolls *6* and *7*, to the left.

4564	LEVER-TYPE CURRENT AMPLIFIER MECHANISM OF A PRINTING DEVICE	LE FD



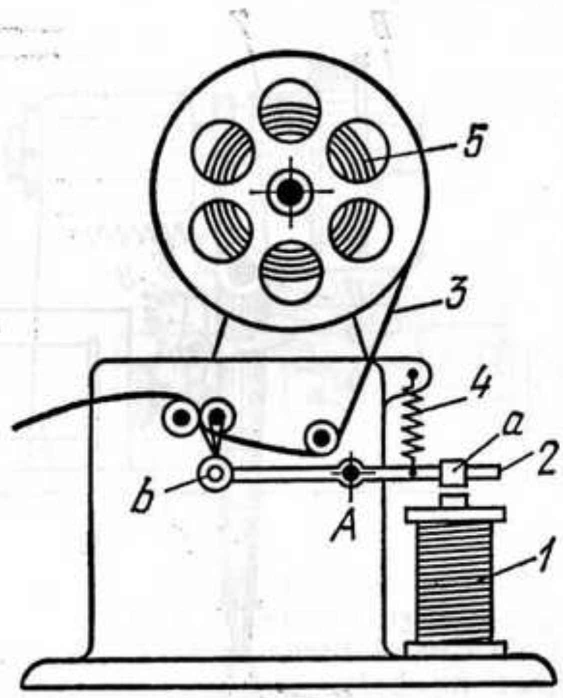
Lever 7 with key *c* turns about fixed axis *A*. Frame *5* turns about fixed axis *B* and is connected by turning pair *C* to contact lever *4*. Drum *1* rotates about fixed axis *D*. When key *c* is pressed, contact lever *4*, mounted on swinging frame *5*, engages the corresponding pin *b* on drum *1*. Pin *b*, running up against lever *4*, pushes it to the left, closing the contacts at *a*. This short-circuits resistor *6*, connected in series into the circuit. As a result, the current from batteries *2* and *3*, supplying the printing device, is amplified.

4565	LEVER-TYPE ELECTROMAGNETIC CLUTCH MECHANISM FOR AUTOMATICALLY STOPPING A PRESS	LE FD



When the electric circuit is closed, the coil of solenoid *2* is energized and its core *1* attracts the end of lever *3*, turning about fixed axis *A*. This turns latch lever *4* about axis *A*, releasing lever *5*. Spring *6* turns lever *5* clockwise about fixed axis *D*, disengaging claw clutch *7*. At this, shaft *B*, linked to the press mechanism, stops. When the circuit is open and the strip stock continues to be fed into the press, spring *8* returns the end of lever *3* to its initial position. Then lever *9* can be turned counterclockwise, engaging clutch *7* so that shaft *B* begins to rotate.

4566	LEVER-TYPE TELEGRAPH APPARATUS MECHANISM	LE FD



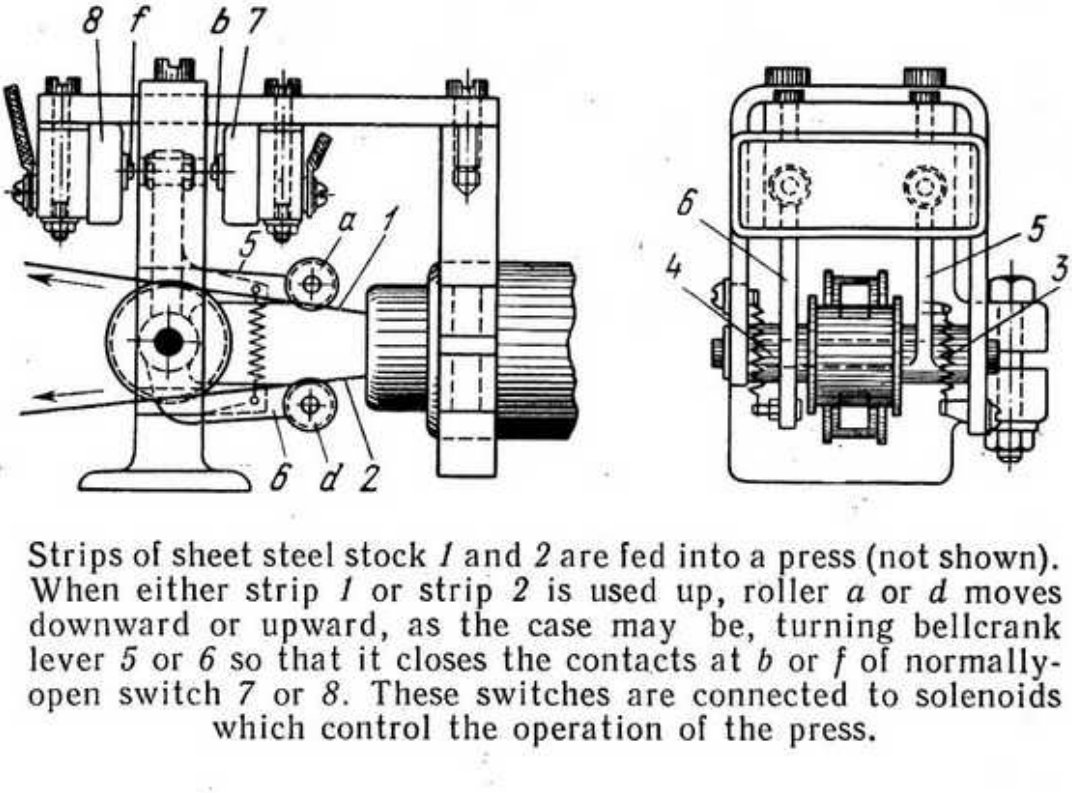
When the winding of electromagnet *1* is energized, armature *a*, rigidly mounted on lever *2*, is attracted to the electromagnet. This turns lever *2* clockwise about fixed axis *A* and small wheel *b*, mounted at the other end of lever *2*, contacts tape *3*, making a line on the tape with paint. Spring mechanism *5* continuously pulls tape *3* past wheel *b*. When the winding of electromagnet *1* is de-energized, spring *4* returns lever *2* to its initial position, interrupting the line on tape *3*.

4567

LEVER-TYPE ELECTRIC-CONTACT AUTOMATIC PRESS STOPPING MECHANISM

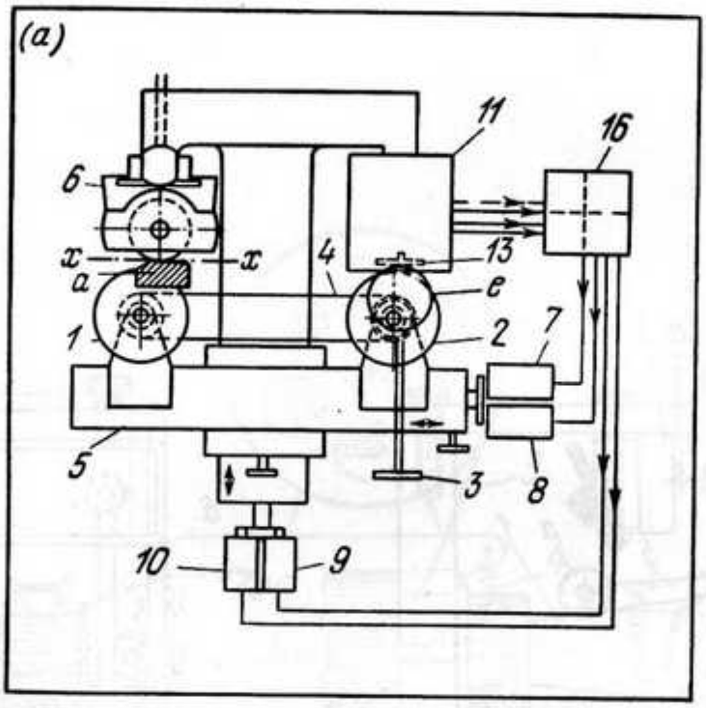
LE

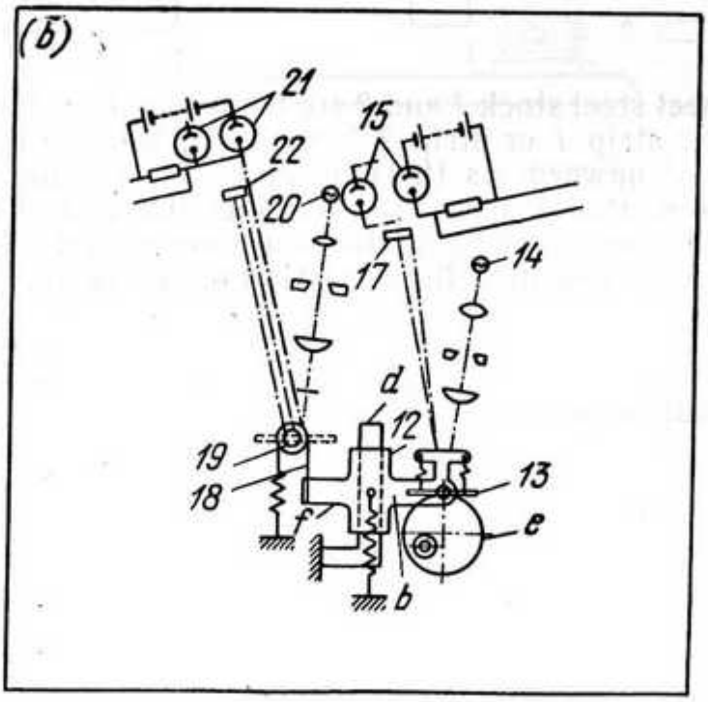
FD



Strips of sheet steel stock *1* and *2* are fed into a press (not shown). When either strip *1* or strip *2* is used up, roller *a* or *d* moves downward or upward, as the case may be, turning bellcrank lever *5* or *6* so that it closes the contacts at *b* or *f* of normally-open switch *7* or *8*. These switches are connected to solenoids which control the operation of the press.

4568	LIGHT-RAY-CONTROLLED PROFILE GRINDING MECHANISM	LE FD





4568	LIGHT-RAY-CONTROLLED PROFILE GRINDING MECHANISM	LE FD

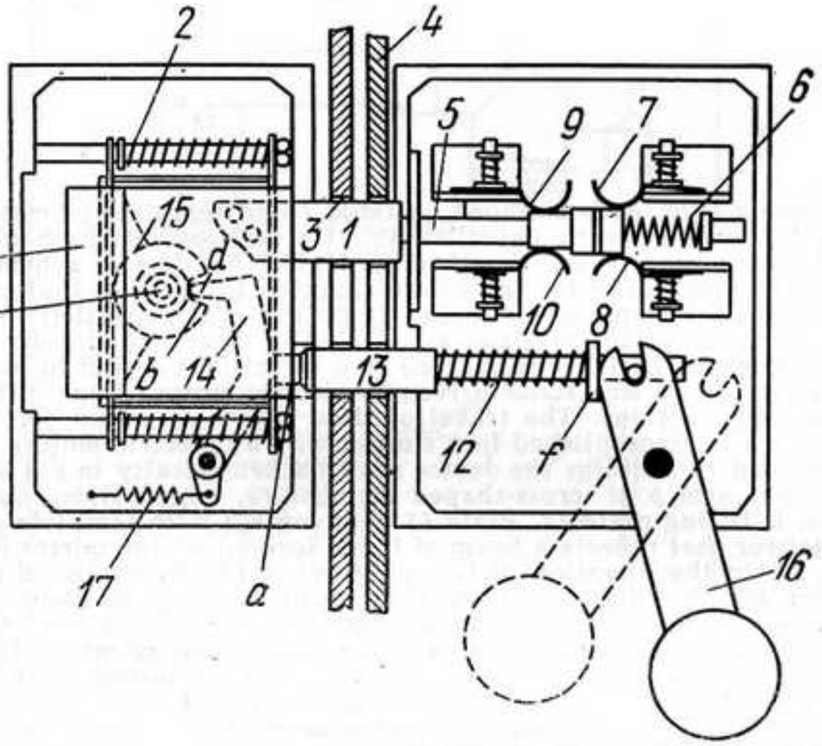
Workpiece *a* (Fig. *a*) is clamped on table *1* and template or master cam *e* on table *2*, which can be swivelled about a vertical axis by handwheel *3*. Tables *1* and *2* are linked together by flexible bands *4* to synchronize rotation. The spindles of the tables are mounted in bearings that are rigidly mounted on the compound slide *5*, which can travel parallel to and perpendicularly to grinding plane *x-x*. Grinding head *6* is rigidly mounted on the upright. The travel of slide *5* in a direction parallel to plane *x-x* is accomplished by a lead screw driven by electric motors *7* and *8* that rotate in opposite directions. The travel of slide *5* in a direction perpendicular to plane *x-x* is accomplished in a similar way by electric motors *9* and *10*. Control head *11* contains the device shown schematically in Fig. *b*. Mounted on right arm *b* of cross-shaped member *12*, which slides along fixed guide *d*, is tilting plate *13*. Plate *13* is in contact with template *e* and carries a mirror that reflects a beam of light, focused on the mirror from light source *14*, in the direction of two phototubes *15*. By means of electronic amplifier *16*, phototubes *15* control the field windings of motors *7* and *8*, starting one or the other motor. Arranged between phototubes *15* is dividing mask *17*. Linked to left arm *f* of cross-shaped member *12* is steel band *18*, running over roll *19*. Roll *19* carries a mirror that reflects a beam of light, focused on the mirror from light source *20*, in the direction of two phototubes *21*. By means of the same electronic amplifier *16*, phototubes *21* control the field windings of motors *9* and *10*. Arranged between phototubes *21* is dividing mask *22*. Upon displacement of the point of contact of plate *13* with template *e* to one or the other side of the tilting axis of plate *13*, the plate tilts and reflects the light beam onto one of phototubes *15*. This excites the field winding of the corresponding motor *7* or *8*, and, as a result, slide *5* travels longitudinally in the corresponding direction. When plate *13* returns to its neutral position, it reflects the light beam onto mask *17* between the phototubes, disengaging longitudinal feed. When the point of contact between template *e* and plate *13* passes out of grinding plane *x-x*, cross-shaped member *12* leaves its normal position on guide *d* and the mirror mounted on roll *19* is tilted to reflect its light beam onto one of phototubes *21*. This excites the field winding of one of the motors, *9* or *10*, which starts to rotate and continues until the point of contact between template *e* and plate *13* coincides again with plane *x-x*.

4569

LEVER-TYPE ELECTRIC-CONTACT ELEVATOR SHAFT DOOR LOCK MECHANISM

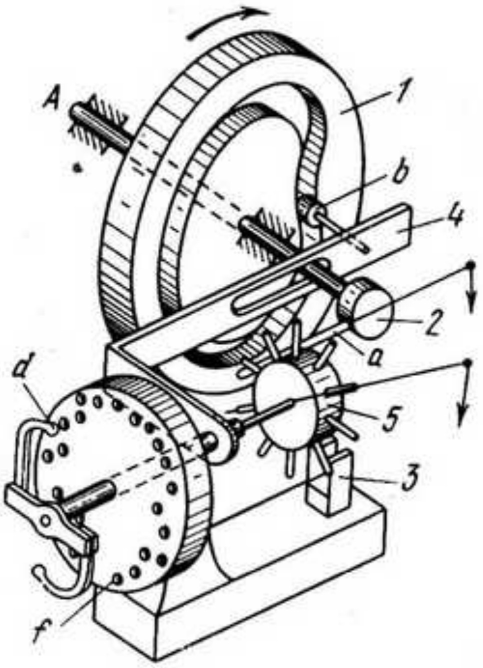
LE

FD



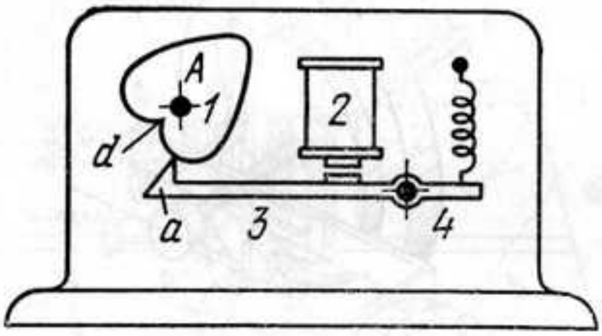
The elevator (lift) shaft door lock has two pairs of contacts: one pair is closed when the doors are closed (to enable the cage to be started) and the other pair is closed when the doors are open (to transmit signals to the other floors that the elevator is engaged). When the doors are closed, bolt *1* of the lock is forced by springs *2* into opening *3* of block *4* of the elevator shaft wall, thereby locking the door. At the same time, bolt *1*, bearing against rod *5*, pushes it to the right, compressing spring *6*, closing contacts *7* and *8* and opening contacts *9* and *10*. The shaft door lock can be opened from inside the shaft by means of carriage *11*, which pulls bolt *1* out of opening *3* of block *4*. If the cage is not aligned with the level of the given floor, rod *13*, by the action of spring *12*, bears against lug *a* of pawl *14*, forcing pin *d* of the pawl into slot *b* of washer *15*. As a result, washer *15* cannot be turned with a key inserted into keyhole *e*. Therefore, the door cannot be opened from outside. If the cage has reached the required floor, the shifting member, mounted on the cage, turns lever *16* to the position shown by dash lines. At this, rod *13* is shifted to the right, compressing spring *12*, which bears against lug *f* of the housing. This releases pawl *14*, which is turned clockwise by spring *17* so that pin *d* is retracted from slot *b* of washer *15*, freeing the washer. In this position, washer *15* can be turned with the key. In turning, washer *15* shifts carriage *11* to the left, compressing springs *2*. This pulls bolt *1* out of opening *3* of the shaft wall and the door can be opened. When the door is open, rod *5* is shifted to the left by spring *6*, opening contacts *7* and *8*, and closing contacts *9* and *10*.

4570	FILTZER LEVER-CAM COMMUTATOR MECHANISM	LE FD

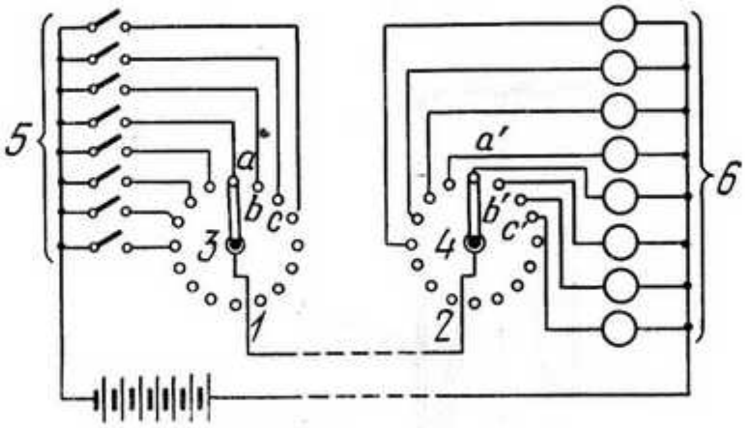


Upon clockwise rotation of face cam *1* and crank *2*, rigidly mounted on the driving shaft, about fixed axis *A*, follower roller *b* reciprocates link *4*. At this, pin *a* of crank *2* rotates pin wheel *5*, whose shaft is mounted in link *4* and reciprocates with the link, bringing moving contact *d* up against stationary contacts *f*. Locking member *3*, which periodically locks pin wheel *5*, ensures coincidence of the contacts during switching.

4571	LEVER-CAM ELECTROMAGNETIC PERIODICAL SYNCHRONISM CORRECTION MECHANISM FOR TWO MOTIONS	LE FD

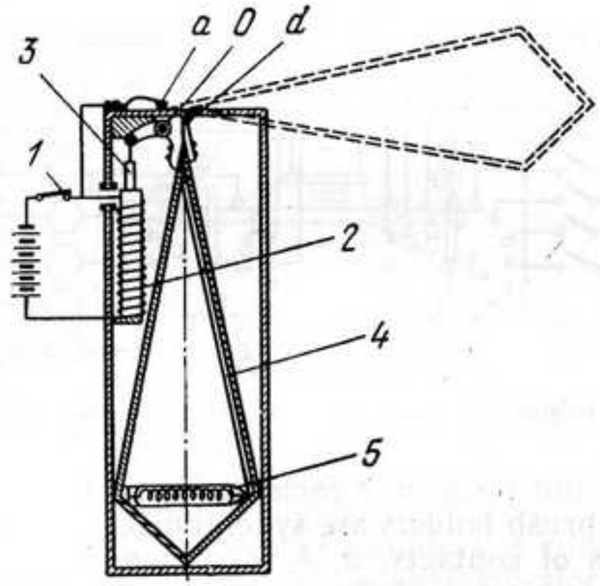


Shaft A of cam 1 should rotate in synchrony with a mechanism (not shown) that transmits pulses to electromagnet 2 so that when the winding of electromagnet 2 is energized, armature 3 is attracted and its pointed lug a enters slot d of cam 1. If synchronism is violated, lug a of armature 3 runs against the profiled surface of cam 1 (instead of entering slot d) when the winding of electromagnet 2 is energized. Cam 1 is profiled in such manner that when lug a of armature 3 bears against a point of its outline, torque is developed that turns shaft A with the cam to the position in which slot d coincides with lug a. This corrects (restores) the synchronism of motion.



Transmitter *1* and receiver *2* each has a rotary brush holder, *3* and *4*. Both brush holders are synchronized and consecutively ride over series of contacts, *a*, *b*, *c*, . . . and *a′*, *b′*, *c′*, . . ., etc., arranged in circles. Owing to the synchronism of rotation, at any instant of time, both brush holders, *3* and *4*, are on like contacts. Connected to each contact of transmitter *1* is a switch *5*, which closes the corresponding operating circuit. Connected to each contact of receiver *2* is an actuating mechanism *6* corresponding to a switch *5*.

4573	LEVER-TYPE ELECTROMAGNETIC TURN SIGNAL MECHANISM FOR AUTOMOBILES	LE FD



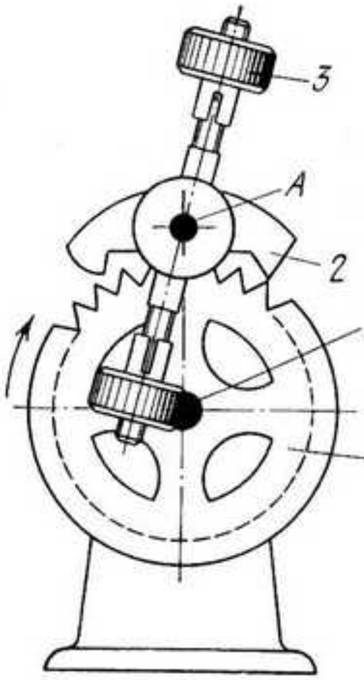
When the electric current is turned on with switch *1*, the winding of solenoid *2* is energized, pulling in armature *3*. This turns signal arm *4* about fixed axis *O* to its horizontal position, shown by dash lines. At this, contacts *a* and *d* are closed, lighting signal lamp *5*.

SECTION THIRTY-FIVE

Toothed Electric Mechanisms TE

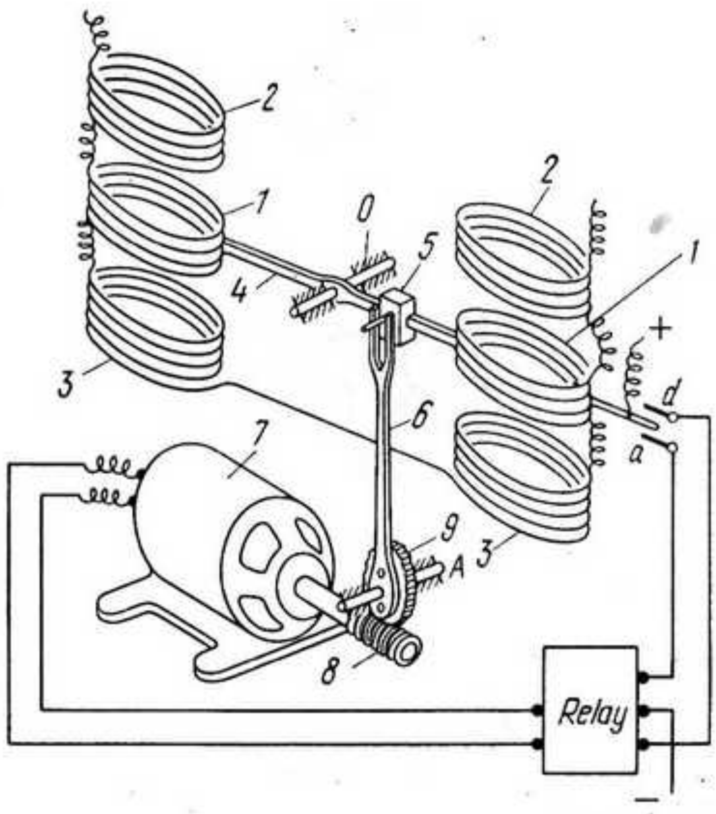
1. RELAY MECHANISMS (4574 through 4592)

4574	TRIGGERING REGULATOR ESCAPEMENT MECHANISM FOR AN ELECTROMAGNETIC RELAY	TE Re

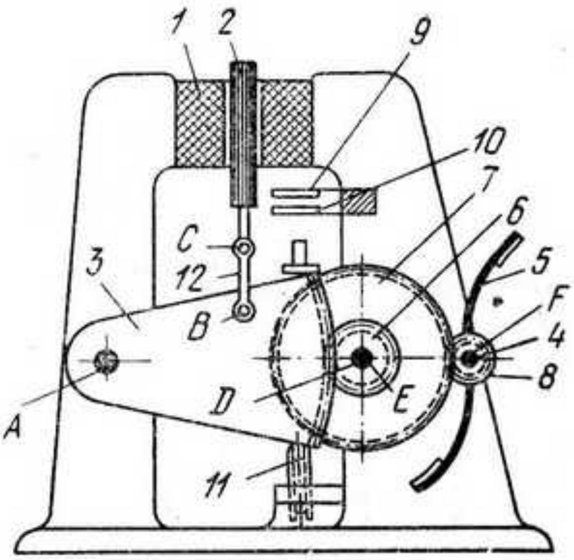


Escape wheel *1* rotates clockwise about fixed axis *B*. Double-ended pawl (anchor) *2* has adjustable weights *3* and is oscillated about fixed axis *A* by the rotation of escape wheel *1*. Owing to the provision of weights *3*, anchor *2* is in equilibrium in any position.

4575	LEVER-GEAR ELECTRODYNAMIC RELAY MECHANISM	TE Re



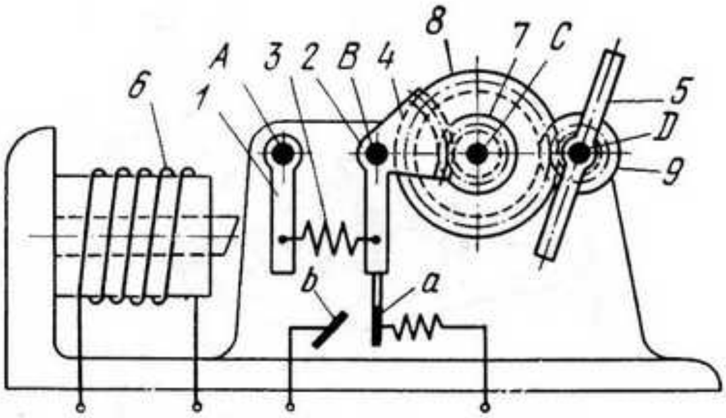
When windings *1*, *2* and *3* are energized, two-arm lever *4*, turning about fixed axis *O*, closes the contacts at *a* or *d*. Lever *4*, is returned to its initial position by balancing member *5*, which is shifted by fork *6*. Fork *6* is rigidly attached to worm wheel *9*, turning about fixed axis *A*. Worm wheel *9* is turned in one or the other direction by electric motor *7* through worm *8*, depending upon whether the contacts at *a* or at *d* are closed.



Armature *2* of electromagnet *1* has reciprocating motion. Link *12* is connected by turning pairs *C* and *B* to armature *2* and to segment gear *3*, turning about fixed axis *A*. Segment gear *3* meshes with pinion *6*, rotating about fixed axis *E* and rigidly attached to gear 7. Gear 7 meshes with pinion *8*, rotating about fixed axis *F*. Air vanes *5* are rigidly mounted on shaft *4* of pinion *8*. When the winding of electromagnet *1* is energized, armature *2* is pulled upward and segment gear *3* is turned counterclockwise, rotating air vanes *5* through gears *6*, *7* and *8*. After segment gear *3* has turned through a definite angle, it closes contacts *9* and *10* of the relay. Owing to the air resistance in the rotation of vanes *5*, a braking torque is developed on shaft *4*. This provides for the time delay, i.e. contacts *9* and *10* are closed with a certain lag after energizing the winding of electromagnet *1*. The time lag, or delay, is regulated with screw *11* by varying the angle through which segment gear *3* turns.

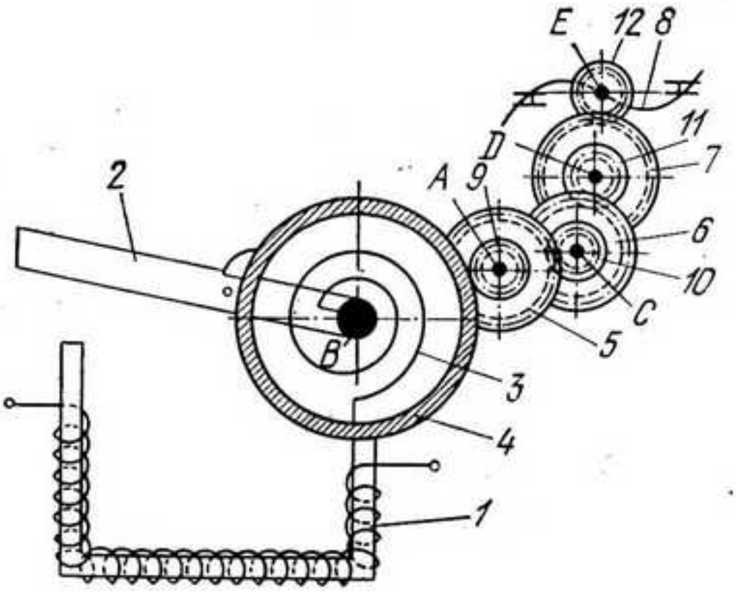
The return stroke of armature *2* is by gravity.

4577	LEVER-GEAR PNEUMATIC TIME RELAY MECHANISM	TE Re



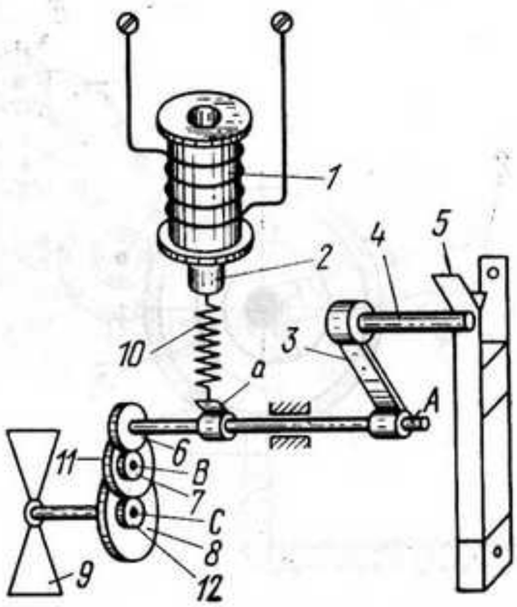
Two armatures, *1* and *2*, of the relay turn about fixed axes *A* and *B* and are linked together by spring *3*. Integral with armature *2* is segment gear *4*, which meshes with pinion *7*. Pinion *7* is rigidly attached to gear *8*, which meshes with pinion *9*, rigidly attached to air vanes *5*. Gears *7* and *8* rotate about fixed axis *C*, and pinion *9* and air vanes *5*, about fixed axis *D*. Armature *2* carries contact *a*. When the winding of electromagnet *6* is energized, armature *1* is attracted, stretches spring *3* and tends to turn armature *2*, whose velocity of motion is slowed down by the air resistance in the rotation of vanes *5*. Thus, contacts *a* and *b* are closed with a certain time delay after the winding of electromagnet *6* is energized.

GEAR-TYPE PNEUMATIC ELECTROMAGNETIC TIME RELAY MECHANISM

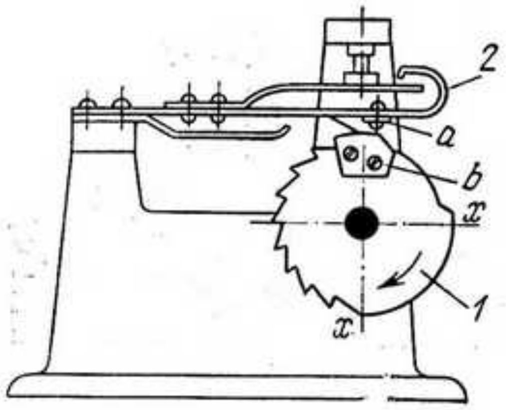


When the winding of electromagnet *1* is energized, armature *2*, turning about fixed axis *B*, is attracted to the core of the electromagnet. This winds up spiral spring *3* which tends to turn drum *4* through a definite angle. A gear on the rim of drum *4* meshes with pinion *9*, rigidly attached to gear *5*, rotating about fixed axis *A*. Air vanes *8* are rigidly attached to pinion *12*, rotating about fixed axis *E*. Rotation is transmitted from gear *5* to pinion *12* by a gear train consisting of two pairs of gears, *10* and *6*, and *11* and *7*, rotating, respectively, about fixed axes *C* and *D*. Owing to the air resistance in the rotation of vanes *8* and the elasticity of spring *3*, the time relay operates with a time delay. The mechanism is returned to its initial position by a spring (not shown).

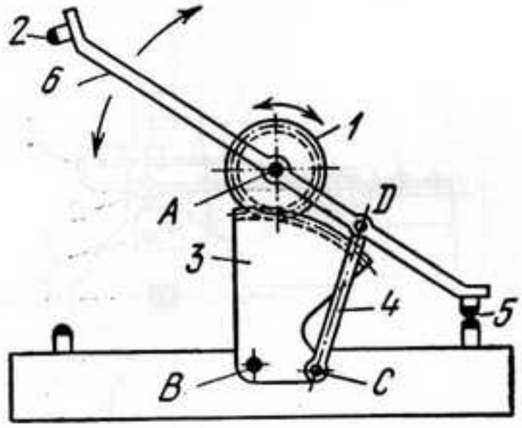
4579	LEVER-GEAR PNEUMATIC TIME RELAY MECHANISM	TE Re



Armature 2 is linked by spring *10* to bracket *a*, which is rigidly attached to lever *3*, turning about fixed axis *A*. Lever *3* has contact pin *4*. Rigidly attached to lever *3* is gear *6*. Rotation is transmitted from gear *6* to air vanes *9*, rigidly attached to pinion *12* and gear *8*, through gears *7*, *11*, *12* and *8*. Gears *7* and *11* rotate about fixed axis *B* and gears *12* and *8*, about fixed axis *C*. When the winding of solenoid *1* is energized, its armature *2* is pulled upward, turning lever *3* to close contacts *4* and *5*. The velocity with which lever *3* turns and, consequently, the time delay of the relay, depends upon the transmission ratio of gears *6*, *7*, *11* and *12*, and the air resistance in the rotation of vanes *9*.

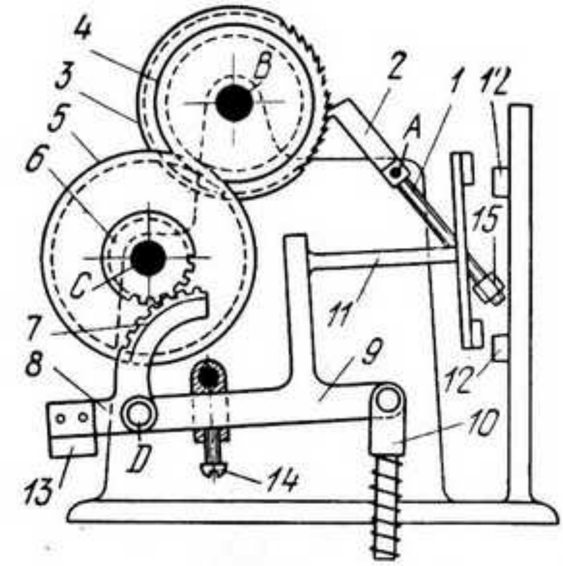


In the idle position, lug *a* of contact spring *2* rests on insulator *b*. When cam *1* is rotated clockwise, the current is switched on in the signal device. The number of teeth on the cam determines the number of times the current is switched on, corresponding to the number of the signalling apparatus. Portion *x-x* of cam *1*, profiled along a circular arc, serves to switch on the fire alarm signal.

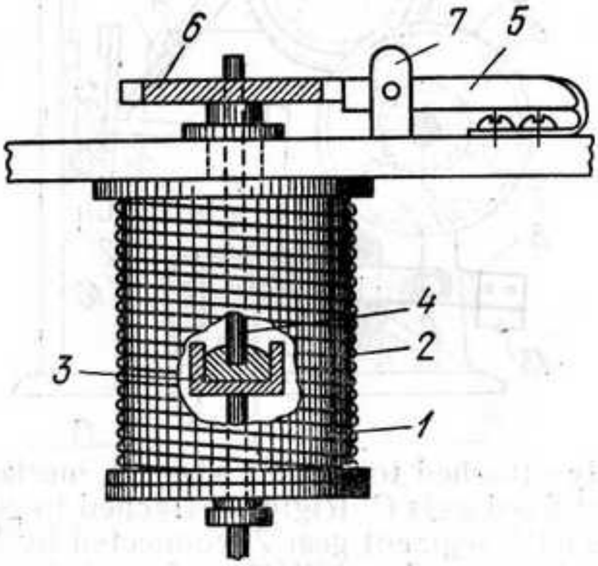


Gear 1 rotates about fixed axis A and meshes with segment gear 3, which turns about fixed axis B. Link 4 is connected by turning pairs C and D to segment gear 3 and to two-arm lever 6, turning freely about axis A and carrying contacts 2 and 5. When the electric motor that drives gear 1 is switched on, one of the pairs of contacts at 2 or 5 is opened and the other pair is closed with a certain time delay.

RATCHET-TYPE PENDULUM TIME RELAY MECHANISM

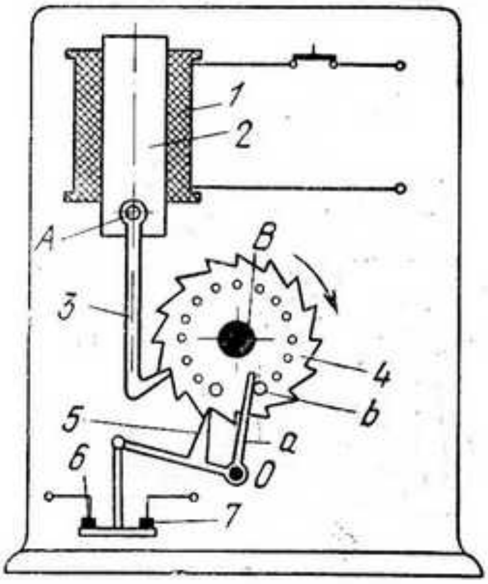


Gear *4*, rigidly attached to ratchet wheel *3*, meshes with gear *5*, rotating about fixed axis *C*. Rigidly attached to gear *5* is gear *6*, which meshes with segment gear *7*, connected by turning pair *D* to lever *9*. During a single oscillation of pendulum *1* with pawl *2* about fixed axis *A*, ratchet wheel *3* turns one tooth about fixed axis *B*, turning segment gear *7* and lever *8* through gears *4*, *5* and *6*. Lever *8* is integral with segment gear *7* and is hinged to lever *9*. When the last tooth of segment gear *7* runs out of mesh with gear *6*, tie-rod *10*, actuated by an electromagnet, turns bridge *11*, closing contacts *12* and transmitting a signal to the operating mechanism. When the electromagnet is de-energized, contacts *12* are opened and weight *13* returns levers *8* and *9* to their initial position. Coarse adjustment of the operating period is accomplished by means of screw *14*, which determines the initial position of lever *8*; fine adjustment is by weight *15* which varies the period of oscillation of pendulum *1*.



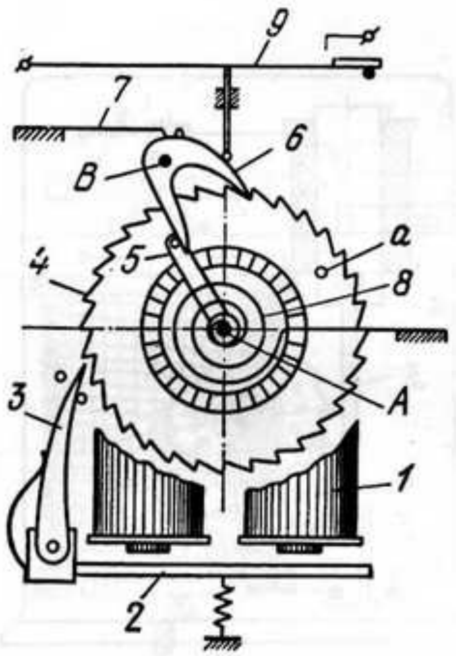
Inside tube *1*, on which heating winding *2* is wound, is cup *3*, containing a fusible alloy. When the current in winding *2* exceeds the permissible value, the metal in cup *3* melts. Shaft *4*, soldered into the fusible metal, can then be turned by the action of contact spring *5*, which bears against the teeth of gear *6*. Gear *6* is rigidly mounted on shaft *4*. At this, contact spring *5* opens the contacts at *7*, breaking the circuit of winding *2*. This mechanism is ordinarily employed as a protective or safety relay.

4584	RATCHET-TYPE COUNTING RELAY MECHANISM	TE Re



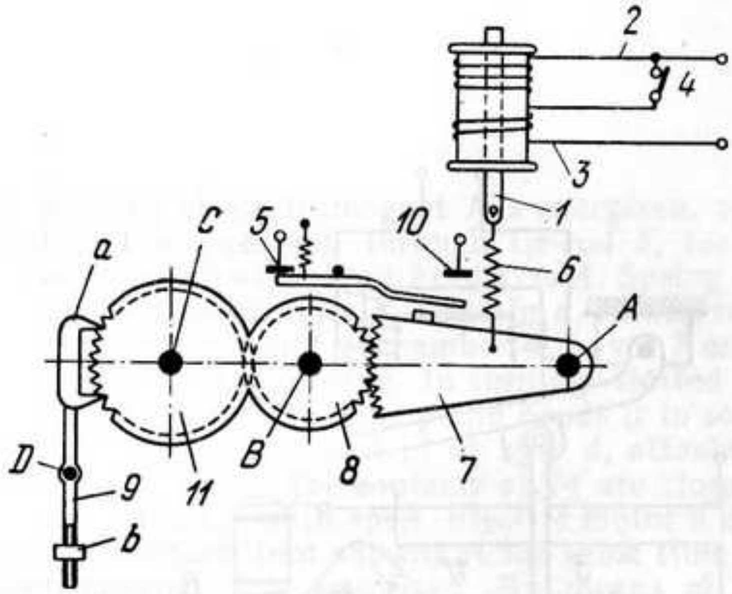
When the winding of solenoid *1* is energized, armature *2* is pulled in and pawl *3*, connected by turning pair *A* to armature *2*, turns ratchet wheel *4* one tooth about fixed axis *B*. When the winding of solenoid *1* is de-energized, armature *2* moves downward and ratchet wheel *4* is locked by pawl *5*. After a definite number of engagements, corresponding to the number of current pulses transmitted to the relay, pin *b*, screwed into one of the holes in disk *4*, turns pawl *5* about fixed axis *O* by means of lever *a*. This opens contacts *6* and *7*, and disk *4* is returned by a spring (not shown) to its initial position. The number of engagements required to trip the relay is varied by screwing pin *b* into another hole.

4585	RATCHET-TYPE COUNTING RELAY MECHANISM	TE Re

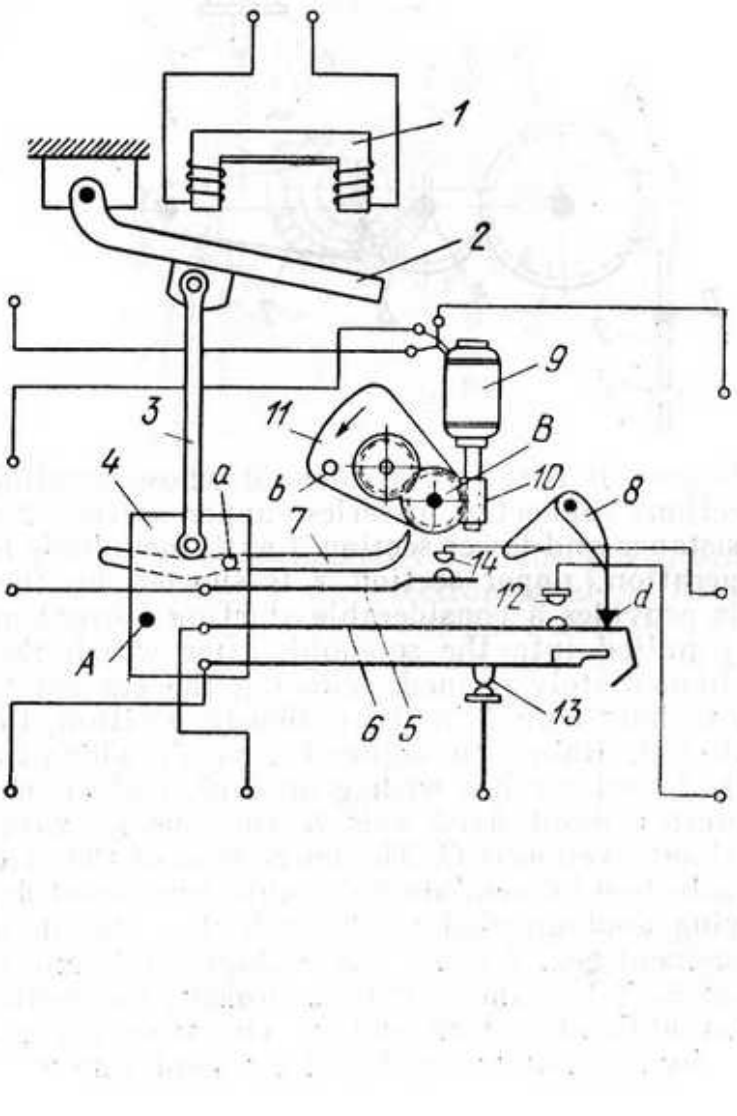


Each time the coil of electromagnet *1* is energized, armature *2* is attracted to the core of the electromagnet so that pawl *3* turns ratchet wheel *4* one tooth about fixed axis *A*. The ratchet wheel is held in each new position by locking pawl *6*, which turns about fixed axis *B*. The number of current pulses transmitted to electromagnet *1* is counted by lever *5*, which turns about axis *A*. After a definite number of pulses, lever *5* engages pawl *6*. Then pawl *6* shifts contact spring *9* from the lower to the upper position. As pawl *6* turns counterclockwise, its lug is engaged by latch *7*. Then, the next time the coil of electromagnet *1* is de-energized, ratchet wheel *4*, no longer held by pawl *6*, is returned to its initial position by spiral spring *8*, with pin *a* striking pawl *6*. This returns pawl *6* to its initial position, and the relay is ready to repeat the counting cycle.

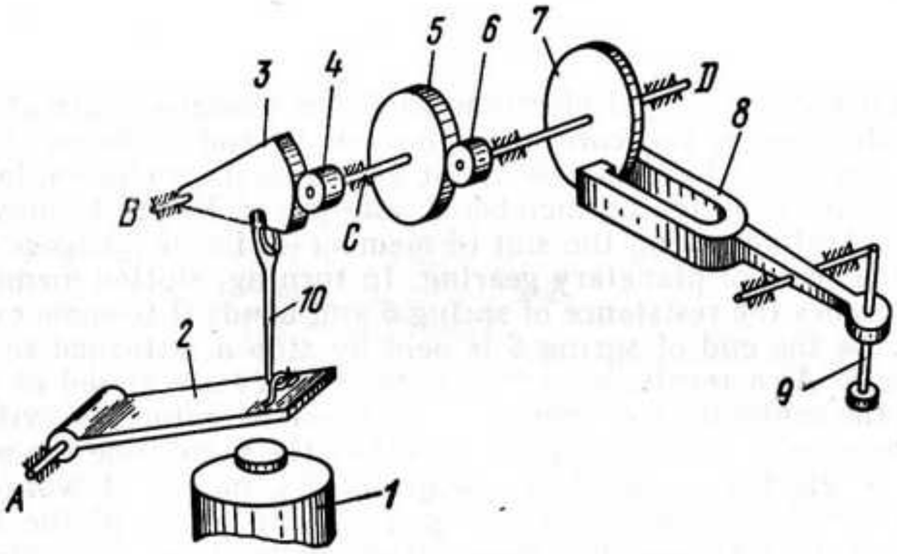
ESCAPEMENT-TYPE PENDULUM TIME RELAY MECHANISM



The mechanism is based on a solenoid whose winding consists of two sections connected in series: upper section *2* with high ohmic resistance and lower section *3* with low ohmic resistance. Before operation, upper section *2* is shorted by the contacts at *4*. This provides a considerable starting current and core *1* is rapidly pulled into the solenoid, after which the contacts at *4* are immediately opened, reducing the current to a value sufficient to hold core *1* in the pulled-in position. Core *1* tensions spring *6*, linked to segment gear *7*, which turns about fixed axis *A* and meshes with gear *8* of a clock mechanism. Gear *8* rotates about fixed axis *B* and meshes with gear *11*, rotating about fixed axis *C*. The movement of the clock mechanism is controlled by pendulum *9*, oscillating about fixed axis *D* and carrying double-ended pawl (anchor) *a*. At the end of its motion, segment gear *7* closes the contacts at *10* and opens the contacts at *5*. When the circuit is broken, the contacts at *10* are opened without a time delay. The time delay is varied by adjusting weight *b* along pendulum *9*.

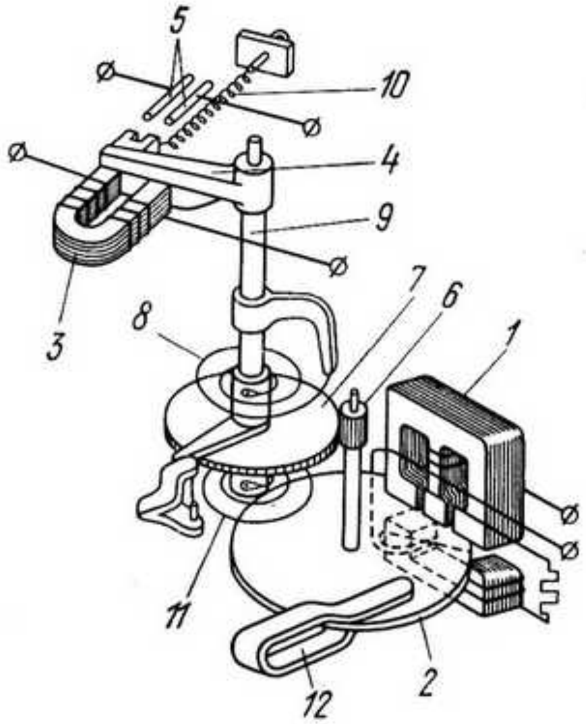

1
2
3
4
a
11
b
7
B
9
10
8
14
12
d
A
6
5
13

When the winding of electromagnet *1* is energized, armature *2* is attracted to the core and, through tie-rod *3*, turns slotted member *4* counterclockwise about fixed axis *A*. Spring contacts *5* and *6* are mounted on member *4*, and pin *a*, linked to movable lever *7*, slides along the slot of member *4*. Lever *7* engages one of the gears of planetary gearing. In turning, slotted member *4* overcomes the resistance of spring *6* and bends it to some extent because the end of spring *6* is held by stop *d*, attached to stop lever *8*. As a result, only the contacts at *14* are closed at first, and the contacts at *12* remain open. Electric motor *9* is switched on by a pair of contacts (not shown) at the same time the winding of electromagnet *1* is energized. By means of worm *10*, motor *9* drives the planetary gearing. Since one of the gears of the planetary gearing is held stationary by lever *7*, carrier *11* begins to turn counterclockwise about fixed axis *B* so that after a certain length of time, controlled by the setting of the relay, stop pin *b* engages and turns lever *8*. This releases spring contact *6*, closing the contacts at *12* and, at the same time, opening the contacts at *13* in the power supply circuit of electric motor *9*. The contacts at *14* and *12* remain closed as long as the winding of electromagnet *1* remains energized. When the winding is de-energized, the relay returns to its initial position.



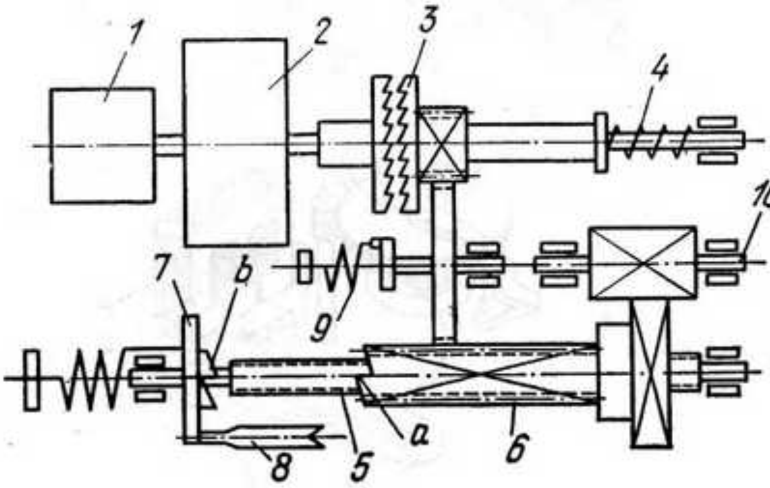
When the winding of electromagnet *1* is energized, armature *2*, turning about fixed axis *A*, is attracted to the core and, through tie-rod *10*, turns segment gear *3* about fixed axis *B*. By means of pinion *4* and gear *5*, rotating about fixed axis *C*, the motion of segment gear *3* is transmitted to pinion *6*, rotating about fixed axis *D* and rigidly attached to braking disk *7*. Disk *7* rotates in the field of permanent magnet *8*. This produces eddy currents in iron disk *7*, which set up a magnetic field that interacts with the magnetic field of permanent magnet *8*. This brakes the rotation of disk *7* on whose shaft the movable contact (not shown) is mounted, and provides for the required time delay of the relay. The delay of the relay can be regulated by displacing permanent magnet *8*, with respect to the axis of disk *7*, by means of adjusting device *9*.

4589	GEAR-TYPE INDUCTION TIME RELAY MECHANISM	TE Re



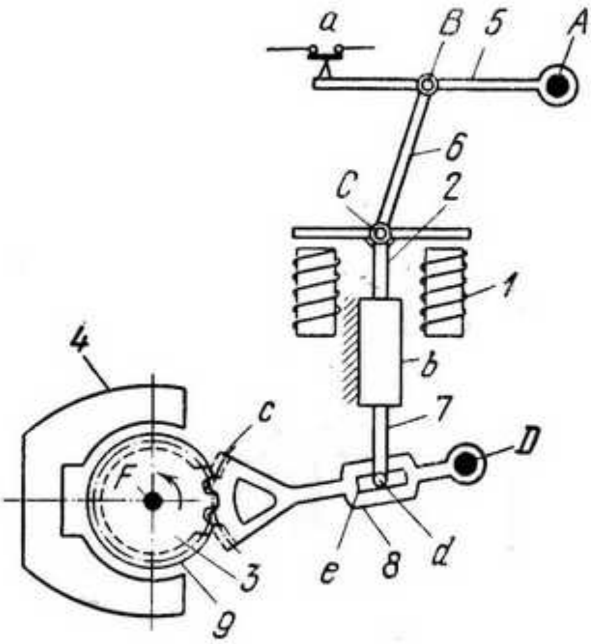
In the initial position, the coil of electromagnet *3* is energized and armature *4* is attracted to the core, opening contacts *5*. When the winding of electromagnet *1* is energized, aluminium disk *2* is turned by the interaction of the electromagnetic fields set up by electromagnet *1* and by the currents induced in disk *2*. Rotation of disk *2* is transmitted by pinion *6*, gear *7* and spiral spring *8* to shaft *9*, on which armature *4* is rigidly mounted. The retraction of armature *4* from electromagnet *3* and the closing of contacts *5* does not occur instantaneously after the winding of electromagnet *1* is energized, but after a definite time delay that depends upon the properties of electromagnets *1* and *3*, the stiffness of springs *8*, *10* and *11* and on the braking torque developed by the electromagnetic damper, consisting of permanent magnet *12*, between whose poles disk *2* is arranged. The braking torque of this damper is due to the interaction between the magnetic field of permanent magnet *12* and the electromagnetic field set up by currents induced in disk *2*.

GEAR-TYPE MOTOR-OPERATED TIME RELAY MECHANISM



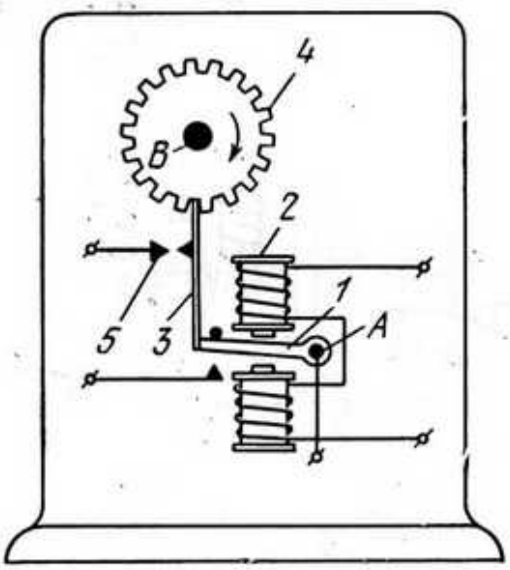
Electric motor *1* drives the left-hand member of claw clutch *3* through reducing gear *2*, which has a high gearing ratio. When motor *1* is switched on, a synchronous motor, actuating the relay, is simultaneously switched on. By means of a tie-rod linked to the armature of the contactor, the right-hand member of clutch *3* is released from a latch and shifted to the left by spring *4* to engage clutch *3*. As a result, long gear *6* begins to traverse axially along screw *5*. After a definite time interval, gear *6* reaches its extreme left-hand position in which its clutch jaws *a* engage clutch jaws *b* of lever *7*. At this, lever *7* turns and shifts lever *8*, by means of which the contacts are switched over. Gear *6* is returned to its initial position by spring *9*, which winds up during operation. The time delay is regulated by adjusting the initial position of gear *6*. This is accomplished by a handwheel linked to shaft *10*.

4591	LEVER-GEAR ELECTROMAGNETIC TIME RELAY MECHANISM WITH A MAGNETIC BRAKE	TE Re



Contact lever *5* turns about fixed axis *A*. Link *6* is connected by turning pairs *B* and *C* to lever *5* and to armature *2*, which reciprocates in fixed guides *b*. Pin *d* of armature *2* slides along slot *e* of lever *8*, which turns about fixed axis *D* and carries segment gear *c*. Segment gear *c* meshes with gear *9*, which is rigidly attached to brake disk *3* and turns about fixed axis *F*. When the winding of electromagnet *1* is energized, armature *2* is attracted by the cores, opening contacts *a*. The time delay is controlled by the braking action of disk *3*, which rotates in the field of permanent magnet *4*.

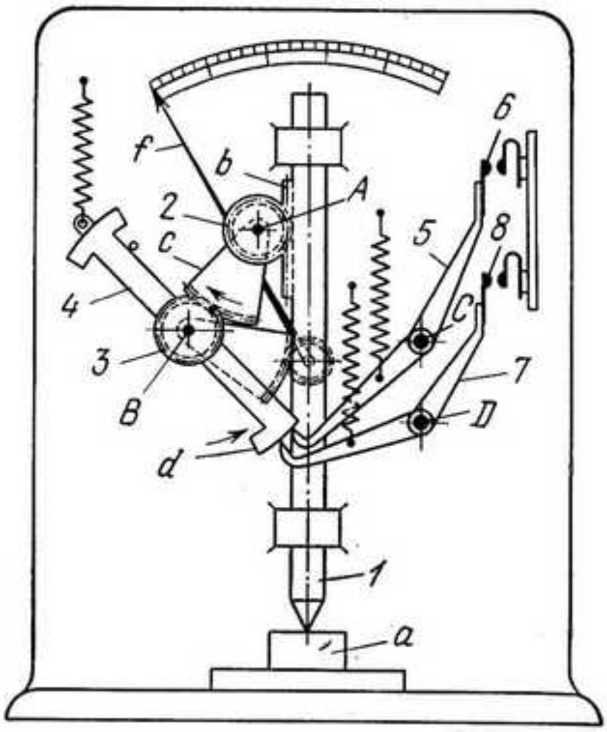
4592	STARTSEV ELASTIC-LINK TOOTHED INTERRUPTER MECHANISM	TE Re



Armature *1* of control relay *2* turns about fixed axis *A* and is rigidly attached to elastic strip *3*. When armature *1* is in its upper position, strip *3* enters a tooth space of gear *4*, which rotates about fixed axis *B*. Upon clockwise rotation of gear *4*, strip *3* bends and after a definite time interval closes the contacts at *5*.

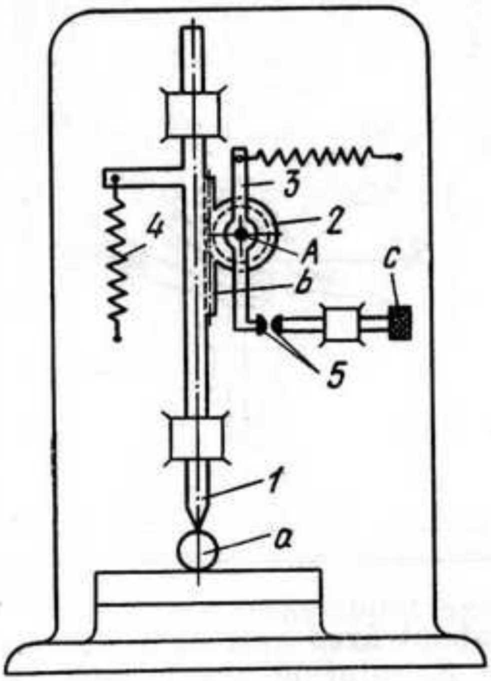
2. MECHANISMS OF MEASURING AND TESTING DEVICES (4593 through 4601)

4593	LEVER-GEAR ELECTRIC-CONTACT AUTOMATIC SIZING MECHANISM FOR A GRINDER	TE M



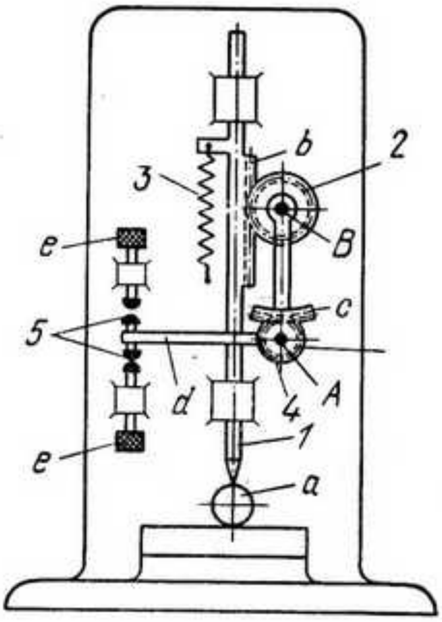
Gear 2, rotating about fixed axis A, has segment gear c, which meshes with gear 3, rotating about fixed axis B. Measuring spindle 1, contacting the workpiece a to be measured, has gear rack b meshing with gear 2. As the size of workpiece a decreases, spindle 1 moves downward and member 4, rigidly attached to gear 3, is turned counterclockwise by the gear train consisting of rack b, gear 2, segment gear c and gear 3. At this, the end of spring-loaded lever 7 slips off the edge of sector d of member 4, turns clockwise about fixed axis D and closes the contacts at 8. This energizes the electromagnet which switches over the grinder to the finishing operation. When the final size of workpiece a is reached, sector d has turned sufficiently for the end of lever 5 to slide off the sector, turn clockwise about fixed axis C and close the contacts at 6. This stops the grinder. The mechanism has hand f, which continuously indicates the size of workpiece a.

4594	RACK-AND-PINION ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	TE M



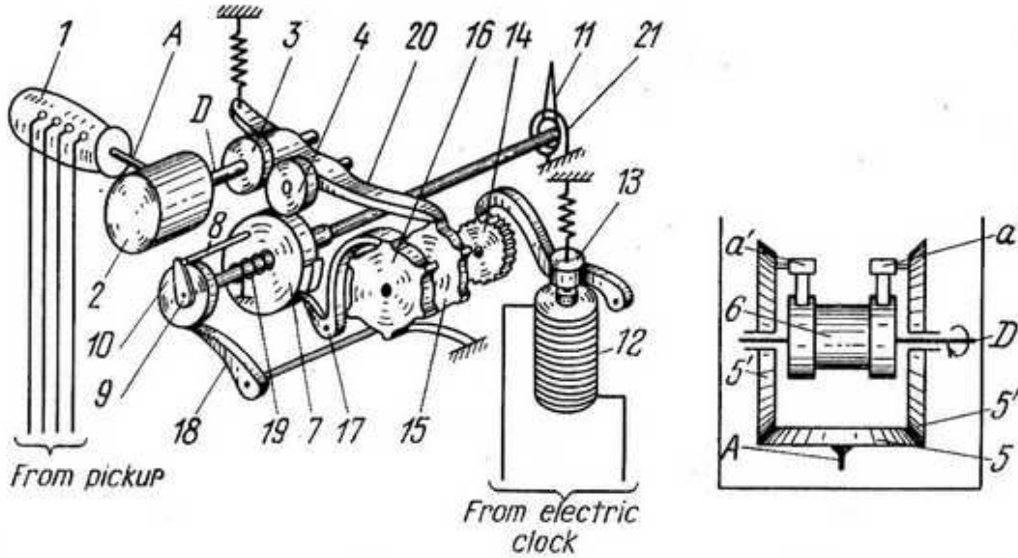
Rigidly mounted on measuring spindle *1*, contacting workpiece *a* being inspected, is rack *b*. Rack *b* meshes with pinion *2*, turning about fixed axis *A*. Rigidly mounted on pinion *2* is lever *3*. In inspecting an undersize workpiece, spindle *1* is moved downward by spring *4*. Rack *b* turns pinion *2* and lever *3* counterclockwise, closing contacts *5*, connected to the signalling device. Contacts *5* are set to the required size of workpiece by adjusting screw *c*.

4595	RACK-AND-PINION ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE INSPECTION	TE M



In inspecting an oversize or undersize workpiece a, measuring spindle 1, held in contact with workpiece a by spring 3, moves up or down. At this, gear rack b, rigidly mounted on spindle 1 and meshing with pinion 2, turns the pinion about fixed axis B together with segment gear c, rigidly attached to pinion 2. Segment gear c meshes with pinion 4, turning about fixed axis A and carrying rigidly attached contacting lever d. Lever d turns downward or upward, closing one of the pairs of contacts at 5, which are connected to the "Oversize" and "Undersize" signal lamps. The contacts are set to the limits of size by screws e.

4596	GEAR-TYPE ELECTRIC-CLOCK TACHOMETER MECHANISM	TE M

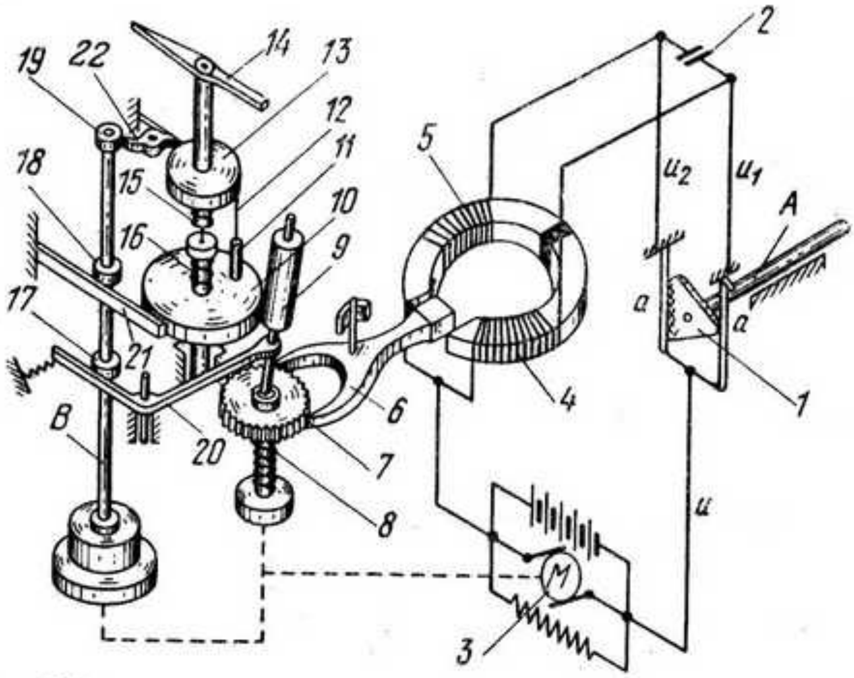


(a) (b)

GEAR-TYPE ELECTRIC-CLOCK TACHOMETER MECHANISM

The shaft whose speed is to be determined is connected to a pickup, carrying four rings and a collector, and to a receiver, designed as synchronous motor *1*. Rotation is transmitted from motor *1* through one-directional device *2* and gear *3* to gear *4*, which always rotates in the same direction. When shaft *A* and bevel gear *5* (Fig. *b*) rotate clockwise, bevel gear *5′* rotates counterclockwise and gear *5″*, whose pawl *a″* engages the teeth of one ratchet wheel of member *6*, rotates clockwise together with shaft *D*. In this case, pawl *a′* of gear *5′* slides over the teeth of its ratchet gear. When shaft *A* rotates counterclockwise, pawl *a′* of gear *5′* turns its ratchet wheel of member *6* and shaft *D* clockwise again. Here, pawl *a″* slides over the teeth of its ratchet wheel. Current pulses from the electric clock are transmitted to electromagnet *12* after definite time intervals. At each current pulse, armature *13* of electromagnet *12* is attracted and turns ratchet wheel *14* only one tooth by means of a special device. Toothed wheels *15* and *16* turn together with ratchet wheel *14*. During the first third of a period, lever *20* is in a position in which gears *4* and *7* mesh. Pawl *17* is retracted from gear 7, and gear 7 with pin *8* turns gear *10* with driver *9*. At this, hand *11* is deflected through an angle proportional to the speed of the shaft being tested. During the second third of the period, lever *20* disengages gears *4* and 7, pawl *17* engages gear 7, and pawl *18* releases gear *10*. During the last third of the period, gears *4* and *7* remain disengaged, pawl *17* is retracted from gear *7*, and gear *7* with pin *8* are turned in the reverse direction by wound-up spiral spring *19*, returning to their initial position. Pawl *18* prevents rotation of gear *10* with driver *9*, and hand *11* remains at rest. If the rotary speed of the shaft being tested remains constant during the second third and all subsequent periods of operation, then pin *8* is in tight contact with driver *9* and hand *11* remains stationary. If the shaft speed decreases, pin *8* of gear *7* does not reach driver *9* of gear *10* and, when pawl *18* is retracted from gear *10*, hand *11* is turned by spiral spring *21* in the reverse direction together with gear *10* until driver *9* contacts pin *8*. If the shaft speed increases, pin *8* of gear *7* bears against driver *9* of gear *10*, turns the gear, together with hand *11* through an additional angle. This winds up spring *21* somewhat more. Thus, each new rotary speed of the shaft whose speed is being measured is indicated by hand *11*.

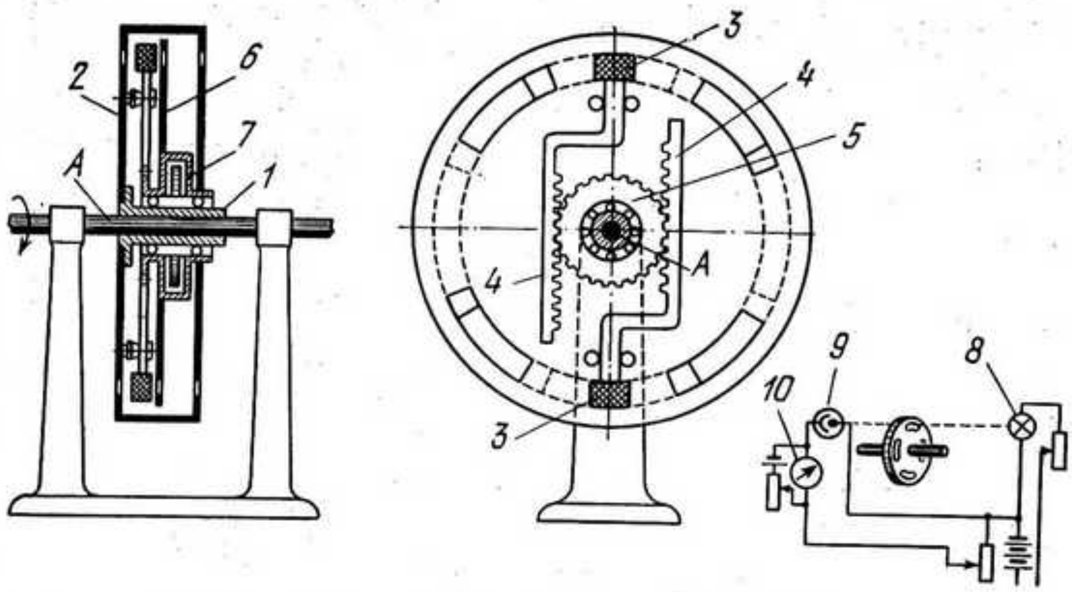
4597	GEAR-TYPE ELECTRIC-CLOCK REMOTE-READING TACHOMETER MECHANISM	TE M



4597	GEAR-TYPE ELECTRIC-CLOCK REMOTE-READING TACHOMETER MECHANISM	TE M

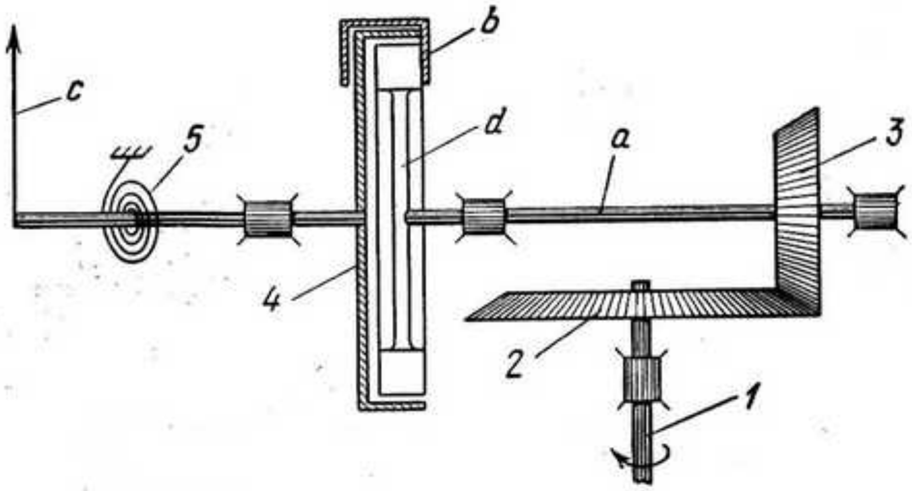
Shaft *A* with cam *1* is driven by the shaft whose speed is to be measured. In rotating, cam *1* closes spring contacts *a*. Current pulses are transmitted alternately along conductors u_1 and u, and u_2 and u. Capacitor *2* serves to quench sparks. The receiver consists of shunt-wound motor *3*, electromagnets *4* and *5* for synchronous transmission of the speed of rotation of the shaft being tested, and the measuring mechanism. Current transmitted from the transmitter alternately energizes the windings of electromagnets *4* and *5*, oscillating the armature at a frequency proportional to the speed of the shaft being tested. The oscillation of the armature is converted into rotation by means of two-ended pawl (anchor) *6* and escapement wheel *7*. Upon each oscillation of anchor *6*, wheel *7* is turned one tooth by spiral spring *8*. Spring *8* is continually wound up by motor *3*. Rotating together with escapement wheel *7* is pinion *9*, whose speed is proportional to that of the shaft being tested. Shaft *B* of the clock mechanism, with rigidly mounted cams *17*, *18* and *19*, is driven by motor *3*. Through lever *20*, cam *17* brings pinion *9* into mesh with gear *10* (spring *21* is retracted from gear *10* at this time), and pin *11*, engaging pin *12* of gear *13*, turns gear *13* together with hand *14* through an angle proportional to the angle of rotation of the shaft being tested during the time interval that pinion *9* and gear *10* were engaged. Then pinion *9* is disengaged and gear *13* remains stationary with braked gear *10*. After this, gear *10* is released and is returned by spiral spring *16* to its initial position. If the speed of the shaft being tested remains constant during the second and all subsequent periods of operation, pin *11* of gear *10* is in tight contact with pin *12* of gear *13*, and hand *14* remains stationary. If the shaft speed decreases, pin *11* of gear *10* does not reach pin *12* of gear *13*, and when pawl *22* is retracted from gear *13* (spring *21* is held against gear *10* during this interval), hand *14*, together with gear *13*, is turned in the reverse direction by spring *15* until pin *12* contacts pin *11* of gear *10*. If the shaft speed increases, pin *11* of gear *10* bears against pin *12* of gear *13*, turning gear *13*, together with hand *14*. This winds up spring *15* somewhat more. Thus, each new rotary speed of the shaft being tested is indicated by hand *14*.

4598	RACK-AND-PINION PHOTOELECTRIC CENTRIFUGAL TACHOMETER MECHANISM	TE M



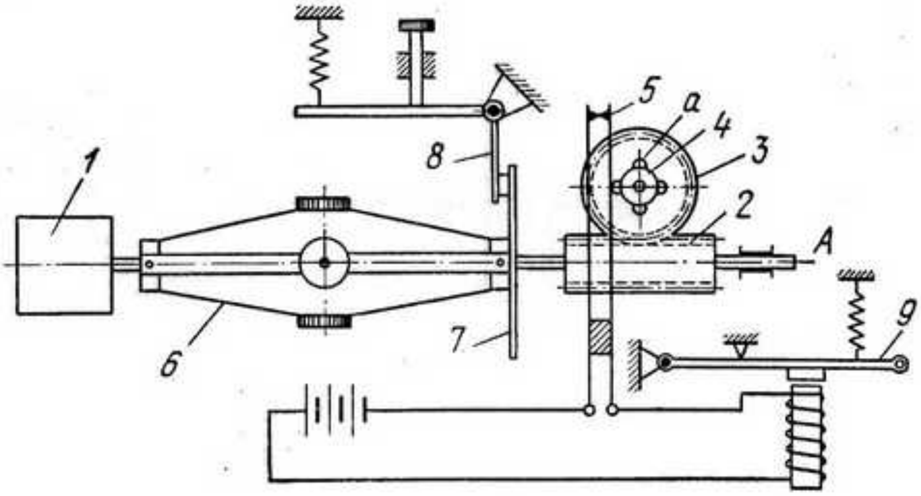
Upon rotation of the shaft whose speed is being measured, motion is transmitted through receiver shaft *A* to housing *2* with clutch *1*. Weights *3* are moved outward by centrifugal forces and, by means of gear racks *4* and pinion *5*, rotating about fixed axis *A*, turn disk *6*, having slots along its circumference, and open a through hole in housing *2* and disk *6*. Pinion *5* and disk *6* are rigidly mounted on sleeve *7*. The size of the through hole depends upon the speed of the shaft being tested. A light beam from lamp *8* passes through the hole and illuminates phototube *9* to excite a current. This current is amplified and conducted to galvanometer *10*. The deflection of the galvanometer hand corresponds to the speed of the shaft being tested.

4599	GEAR-TYPE MAGNETIC TACHOMETER MECHANISM	TE M



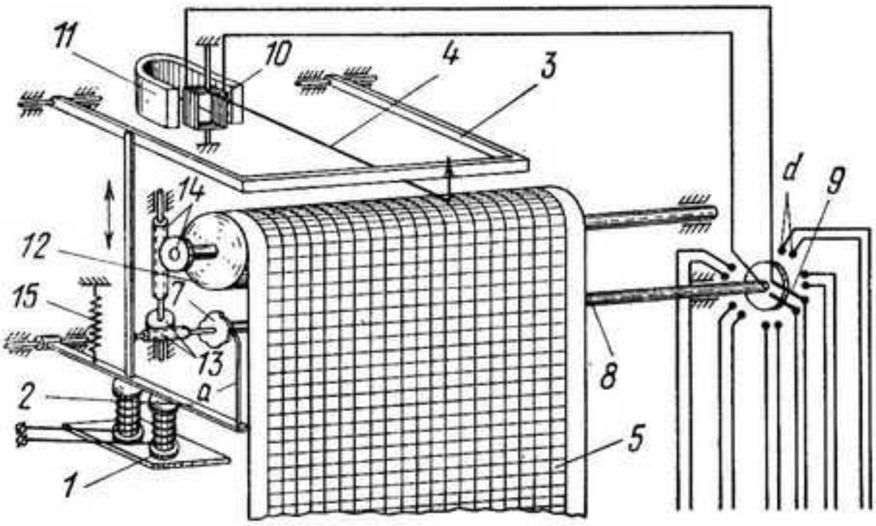
Rotation of shaft *1* of the tachometer is transmitted by bevel gears *2* and *3* to shaft *a* on which magnet *d* is rigidly mounted. Iron component *b* is secured to the magnet at a pole and rotates with the magnet. Component *b* serves to conduct the flux of lines of force through aluminium cup *4*. Upon asynchronous rotation of the magnet (with respect to cup *4*), eddy currents are induced in the web of the cup. These currents set up a field which interacts with the field of magnet *d* so that cup *4* has a tendency to turn in the direction of rotation of the magnet, turning hand *c* of the tachometer. Spring *5* resists rotation of hand *c* and returns it to its initial position when shaft *1* stops rotating.

WORM GEARING ELECTRIC-CONTACT TIME MARKER MECHANISM



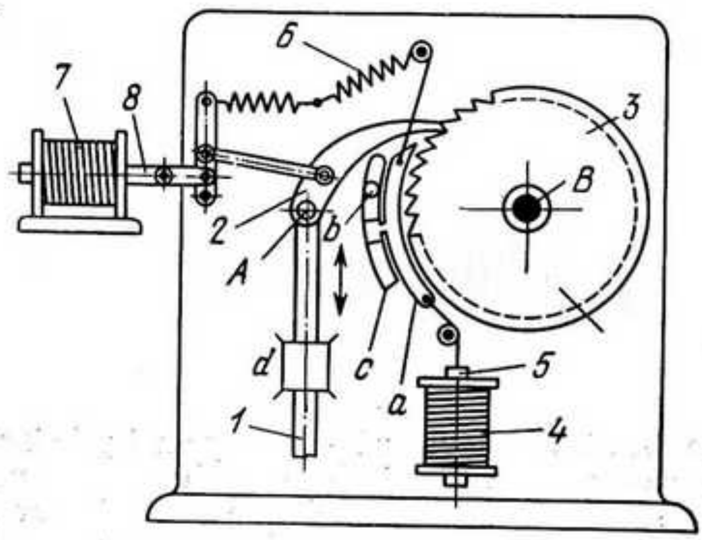
Worm *2* rotates about fixed axis *A* and meshes with worm wheel *3*, having rigidly attached disk *4* with lugs *a*. When electric motor *1* is switched on, disk *4* closes contacts *5* of a circuit including a storage battery and electric time marker *9*. Uniform rotation and an adjustment of the time intervals between the closing of contacts *5* are accomplished by means of centrifugal governor *6*, which has braking disk *7*, and adjustable braking device *8*.

4601	GEAR-TYPE SIX-INK CHOPPER-BAR ELECTRIC-CONTACT RECORDER MECHANISM	TE M



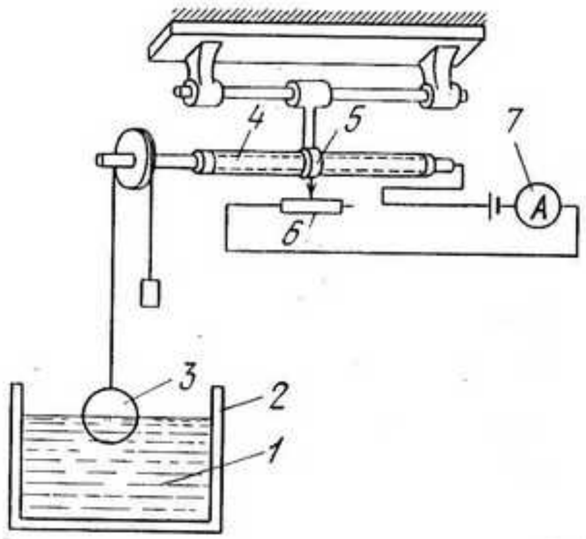
This mechanism is employed when the quantity being measured varies too slowly or when it is expedient to record several quantities on a single tape. After definite time intervals, a clock mechanism (not shown) energizes the winding of electromagnet *1*. Armature *2* is attracted to the core of the electromagnet and pulls down chopper bar *3*, which presses hand *4* against paper *5* and to the ink-impregnated padding under the paper tape. When the winding of electromagnet *1* is de-energized, armature *2* is retracted by spring *15*. This raises bar *3* and releases hand *4*, which can turn to a new position. Hand *4* is set in the new position as follows. When armature *2* is retracted from the core of electromagnet *1*, pawl *a*, mounted on armature *2*, turns ratchet wheel *7*, rigidly mounted on shaft *8*. At this, movable contacts *9* are turned from one pair of fixed contacts *d* to another pair, corresponding to the new quantity to be measured. Moving coil *10*, arranged in the field of permanent magnet *11*, receives a new current pulse and turns hand *4*, mounted on the coil, to a new position. Roll *12* with the ink-impregnated padding is turned by ratchet wheel *7* through worm gearing units *13* and *14*.

4602	RATCHET-TYPE ELECTROMAGNETIC MECHANISM WITH DRIVEN LINK ROTARY SPEED REGULATION	TE Rg



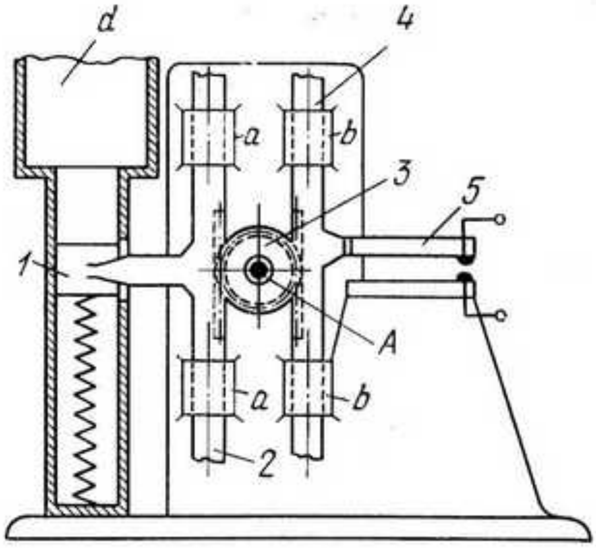
Upon reciprocation of bar *1* in fixed guide *d*, pawl *2*, connected by turning pair *A* to bar *1*, engages and turns ratchet wheel *3* about fixed axis *B*. When the winding of electromagnet *4* is de-energized, armature *5* is retracted from the electromagnet by spring *6*, raising shield *a* so that pawl *2* engages less teeth of ratchet wheel *3* each time, reducing the speed of the ratchet wheel. The number of teeth engaged by pawl *2* is regulated by adjusting stop *b* along slot *c*. When the winding of electromagnet *7* is energized, pawl *2* is retracted from ratchet wheel *3* by armature *8* and stops rotating the ratchet wheel.

4603	SCREW-TYPE VARIABLE-RESISTANCE FLOAT-LIQUID-LEVEL INDICATOR MECHANISM	TE Rg



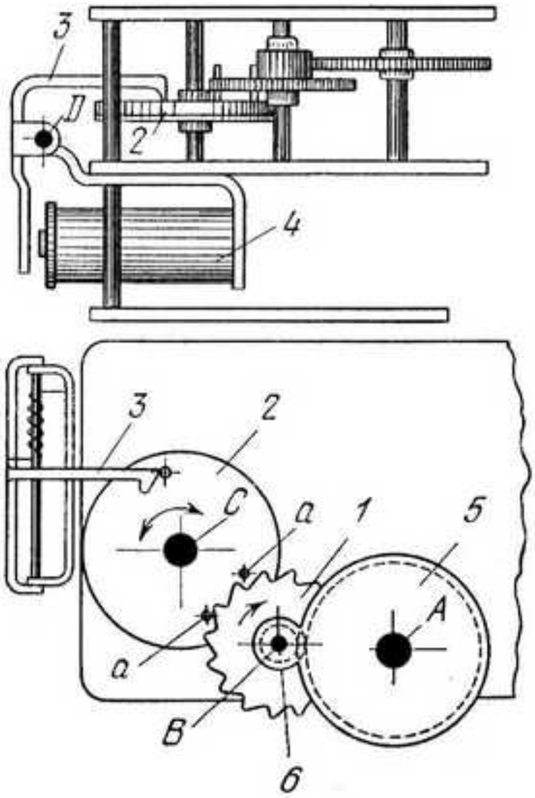
Upon a change in the level of liquid *1* in tank *2*, float *3* is raised or lowered, turning screw *4*. At this, nut *5*, which is also the slider of rheostat *6*, moves in one or the other direction, changing the resistance of the rheostat. This changes the current in the circuit and is indicated by ammeter *7*.

4604	RACK-AND-PINION ELECTRIC-CONTACT PRESSURE REGULATOR MECHANISM	TE Rg



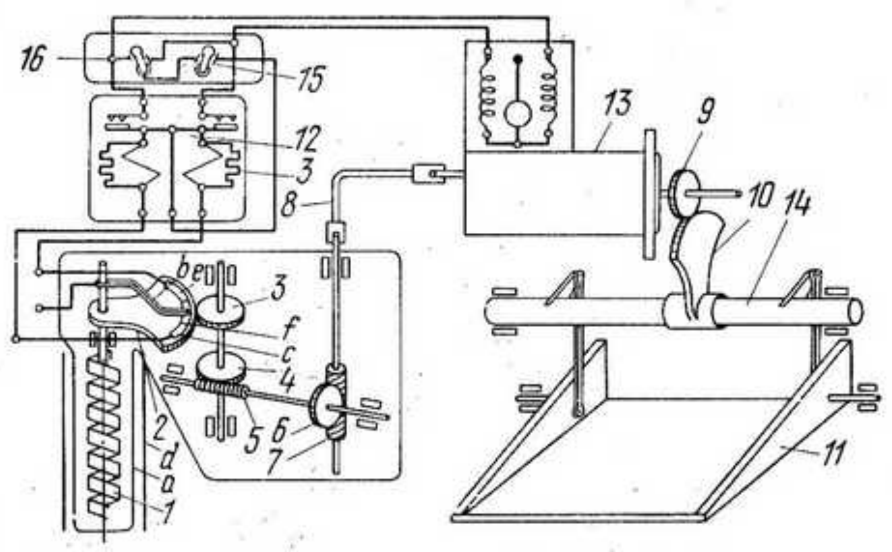
Pinion *3* rotates about fixed axis *A* and meshes with gear racks *2* and *4*, which reciprocate in fixed guides *a-a* and *b-b*. When the pressure of the gas in cylinder *d* increases, piston *1* moves downward with rack *2*, turning pinion *3* counterclockwise and moving rack *4* upwards. This opens switch *5*, whose upper lever is mounted on rack *4*, and breaks the circuit of the drive for the mechanism that delivers gas into cylinder *d*. When rack *4* moves downward, switch *5* closes the pump drive circuit.

4605	GEAR-TYPE RETURN-MOTION ELECTROMAGNETIC SPEED REGULATOR MECHANISM	TE Rg



Gear 5 rotates about fixed axis A and meshes with pinion 6, which rotates about fixed axis B and is rigidly attached to escape wheel 1. Escape wheel 1 periodically engages a pin a of balance wheel 2. Wheel 1 is driven clockwise by means of a drive motor (not shown). At this, balance wheel 2 oscillates from the impulses transmitted by escape wheel 1 and lever 3, which returns balance wheel 2 to its initial position due to the action of electromagnet 4. When the winding of electromagnet 4 is energized, lever 3, turning about fixed axis D, releases balance wheel 2 and the speed regulator begins to operate.

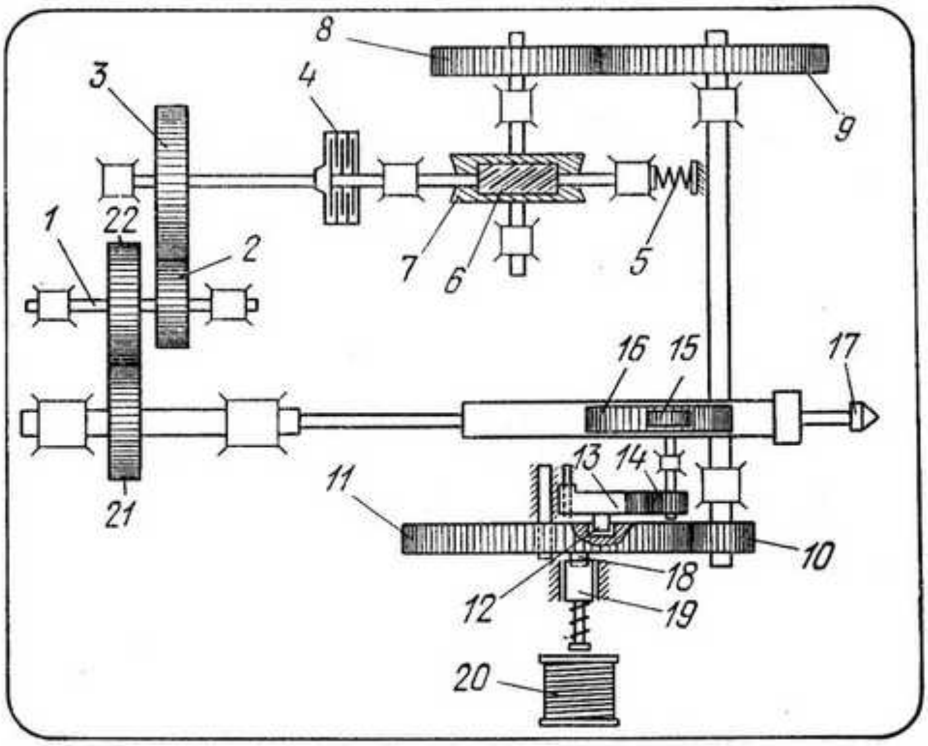
4606	GEAR-TYPE ELECTRIC-CONTACT TEMPERATURE REGULATOR MECHANISM FOR COOLING AND LUBRICATION SYSTEMS OF AIRCRAFT	TE Rg



4606	GEAR-TYPE ELECTRIC-CONTACT TEMPERATURE REGULATOR MECHANISM FOR COOLING AND LUBRICATION SYSTEMS OF AIRCRAFT	TE Rg

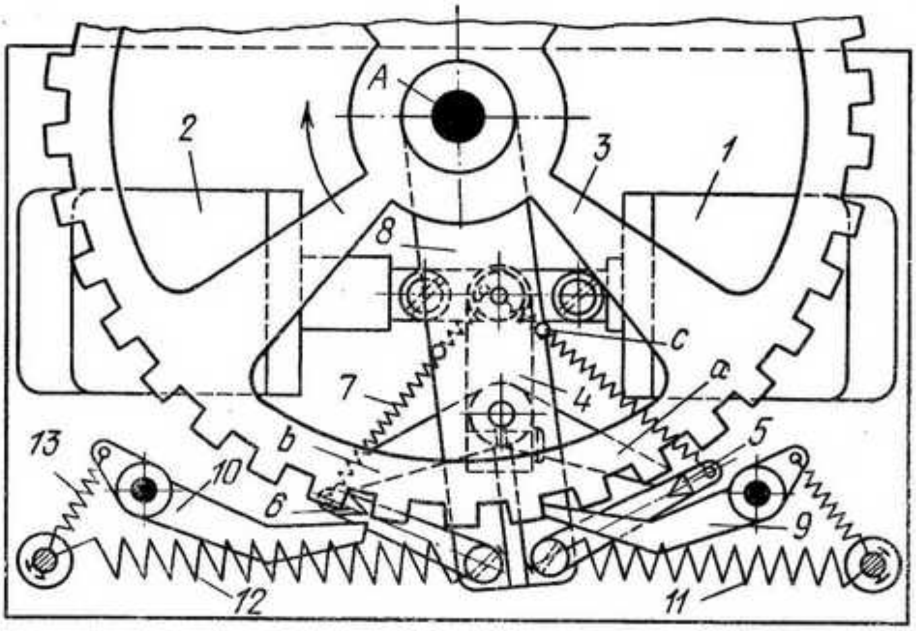
The automatic temperature regulating device, actuating shutter *11* of the radiator of the cooling or lubrication system, maintains a definite temperature in the system. When the temperature drops below the permissible level, the automatic device covers the radiator to some extent with shutter *11*. This reduces the air cooling effect and the temperature of the cooling fluid is increased. When the temperature increases above the permissible level, the automatic device opens radiator shutter *11*, air cooling increases and the temperature of the cooling fluid is reduced. The thermal element of the automatic device is a bimetallic thermometer, consisting of bimetallic helix *1* in protective tube *a*, which is mounted in pipeline *d* of the cooling fluid. The lower end of helix *1* is fixed and the upper end is linked to contact brush *b*, which can slide along insulated section *f* or along two contact strips, *e* and *c*. When the temperature of the cooling fluid equals the specified value, brush *b* is on section *f*. Upon a change in temperature, bimetallic helix *1* winds up or unwinds to some extent so that brush *b* slides along strip *c* or *e*. At this, double-coil electromagnetic relay *12* energizes or de-energizes one of the windings of reversible electric motor *13*. Motor *13* controls the position of radiator shutter *11* by means of gear *9*, which meshes with segment gear *10*. Segment gear *10* is rigidly mounted on driving shaft *14* of a four-bar linkage that controls radiator shutter *11*. At this, by means of flexible shaft *8* and double worm gear reducing units, with members *7*, *6*, *5*, *4* and *3*, motor *13* turns movable sector *2* with contact strips *c* and *e* in the direction of brush *b*, so that the brush is again on insulated section *f*. This opens the winding circuit of the relay, switching off electric motor *13*. Owing to this feedback effect, the regulator has a proportional characteristic, the electric motor being switched on somewhat before the specified temperature is reached. This prevents excess opening or closing of shutter *11*. The train of reducing gears, consisting of worms *5* and *7*, worm wheels *4* and *6*, and gear *3*, reduces the speed of rotation transmitted from motor *13* to movable sector *2*. Throw-over switch *15* serves to switch off the automatic device. In this case, electric motor *13* is controlled by double-throw switch *16*.

4607	CAM-GEAR SOLENOID-CONTROLLED FEEDING MECHANISM	TE SF



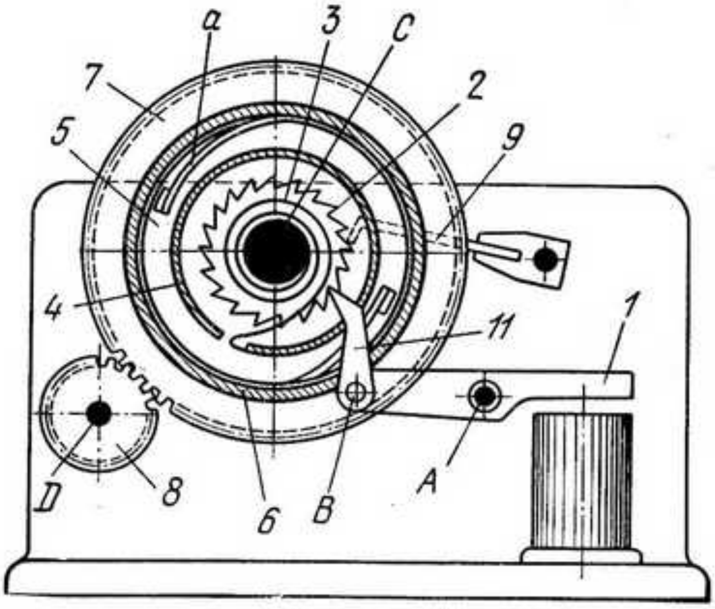
By means of gears *2* and *3* and friction clutch *4*, whose disks are pressed together by spring *5*, rotation is transmitted from shaft *1* to worm *6*, which has some axial motion. Rotation is transmitted further from worm *6* through worm wheel *7*, and gears *8*, *9* and *10* to gear *11* with a curvilinear slot on its face. Upon rotation of gear *11*, its curvilinear slot actuates pin *12* of segment gear *13*. Segment gear *13* turns pinions *14* and *15*, rigidly attached together, which transmit the feeding motion to rack *16*, meshing with gear *15*, and to spindle *17*, rigidly attached to rack *16*. After making one full revolution, gear *11*, with its lug *18*, runs up against sliding stop *19*, which prevents further rotation. This stops worm wheel *7*. Worm *6*, meshing with stationary worm wheel *7*, moves axially to the right, compressing spring *5*, as a result of which clutch *4* is disengaged. To re-engage the feed, sliding stop *19* is retracted by solenoid *20* to release gear *11*. Gear *22* meshes with gear *21*, which is rigidly mounted on spindle *17* and drives the spindle.

4608	RATCHET-TYPE SOLENOID-OPERATED REMOTE-CONTROL MECHANISM	TE Co



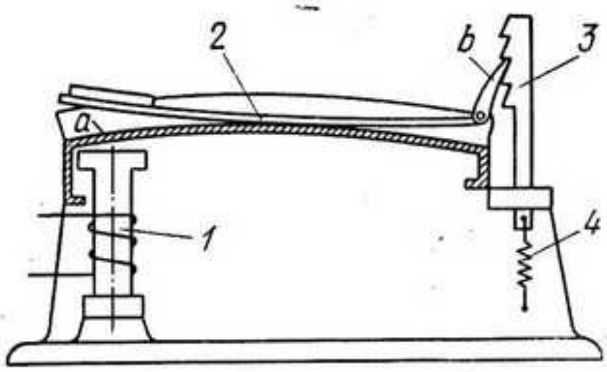
When the winding of one of two solenoids, *1* or *2*, is energized, ratchet wheel *3* is turned about fixed axis *A* in one or the other direction through an angle corresponding to one tooth. Shown is the energizing of the winding of solenoid *1*. Lever *4* is tilted, turning arms *a* and *b* so that arm *a* disengages pawl *5* from ratchet wheel *3*. Spring *7* engages pawl *6* with the ratchet wheel, disengaging pawl *10*. Pawl *9* remains engaged to the ratchet wheel, preventing its counterclockwise rotation. As it is tilted, lever *4* engages pin *c* of lever *8*, turning lever *8* about axis *A*. When the winding of solenoid *1* is de-energized, lever *8* is shifted to its middle intermediate position by springs *11* and *12*. Pawl *6* turns the ratchet wheel clockwise through an angle corresponding to one tooth. After this, pawl *10*, brought into engagement with the ratchet wheel by spring *13*, stops the ratchet wheel.

4609	RATCHET-TYPE ELECTROMAGNETIC SPRING-LINK DRIVE MECHANISM	TE Dr



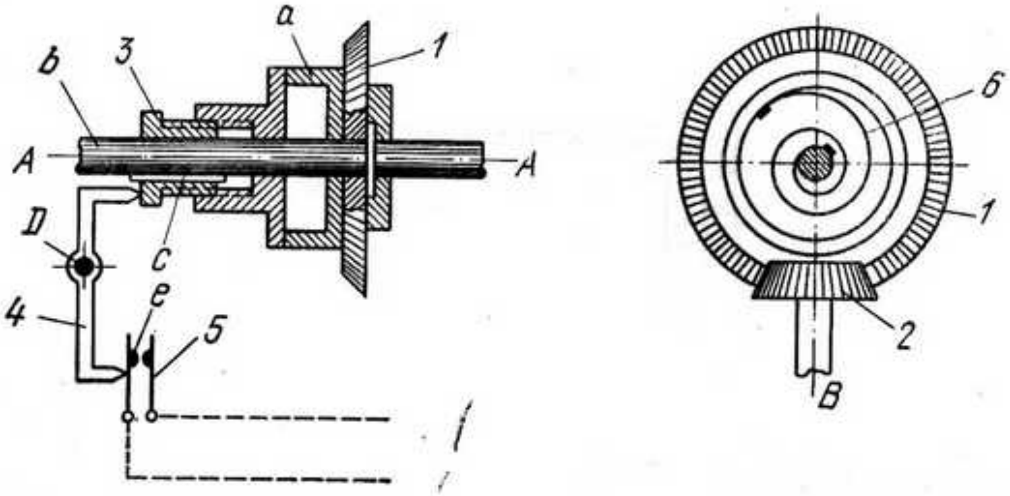
When lever *1*, turning about fixed axis A, is attracted by the electromagnet, pawl *11*, connected by turning pair B to lever *1*, rotates ratchet wheel *2* one tooth counterclockwise. Ratchet wheel *2* rotates about fixed axis C, winding up spiral spring *3*, which has one end attached to drum *4* and the other to shaft C. By means of friction shoes a, secured to disk *5*, which is held by screws to drum *4*, drum *4* engages external drum *6*. Drum *6* is rigidly attached to gear *7*, which drives gear *8* about fixed axis D. Spring pawl *9* prevents reverse rotation of ratchet wheel *2*.

4610	RATCHET-LEVER ELECTROMAGNETIC ROLLING LEVERS MECHANISM	TE Dr



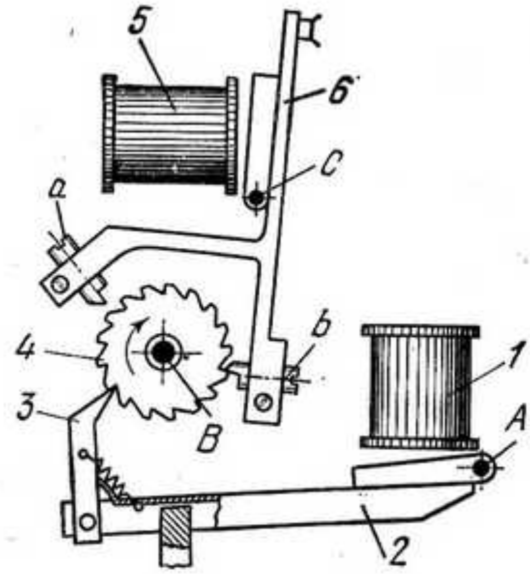
When electromagnet *1* attracts lever *2*, the latter rolls on profiled upright *a* and, by means of pawl *b*, shifts rack *3* one tooth upward. Spring *4* returns rack *3* to its initial position.

4611	GEAR-TYPE THREADED-SLEEVE ELECTRIC CLOCK WINDING MECHANISM	TE Dr



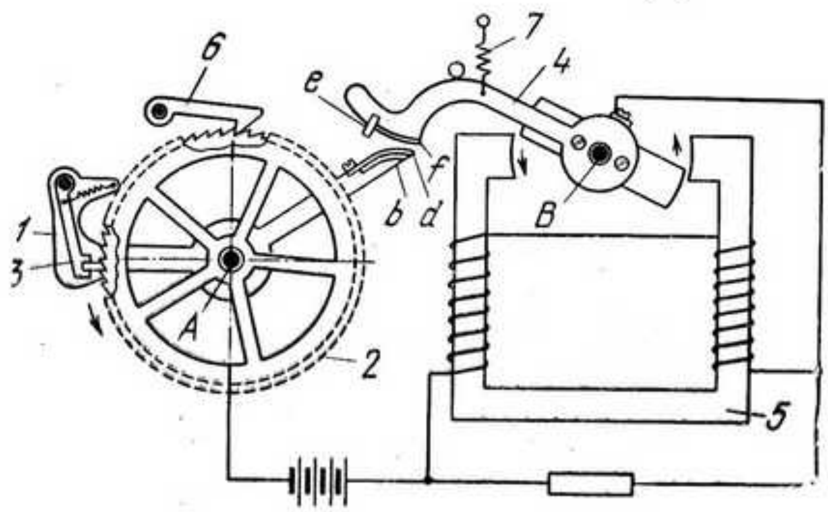
Meshing bevel gears *1* and *2* rotate about fixed axes *A* and *B*. Freely mounted on driven shaft *b* is bevel gear *1* to which drum *a* is rigidly attached. Fastened to the inner wall of drum *a* is spiral flat spring *6*, with its other end fastened to shaft *b*. The front wall of drum *a* has a threaded recess into which threaded sleeve *3* fits. Sleeve *3* can slide along shaft *b* and rotates together with the shaft because it is mounted on feather key *c*. Spring *6* is wound by rotating gear *2*. When spring *6* unwinds, it shifts sleeve *3* to the left until it reaches lever *4*, turning about fixed axis *D*, which closes the contacts at *e* of spring *5*. This switches on the electric motor for winding up the spring again.

4612	RATCHET-TYPE ELECTROMAGNETIC SPRING DRIVE MECHANISM	TE Dr



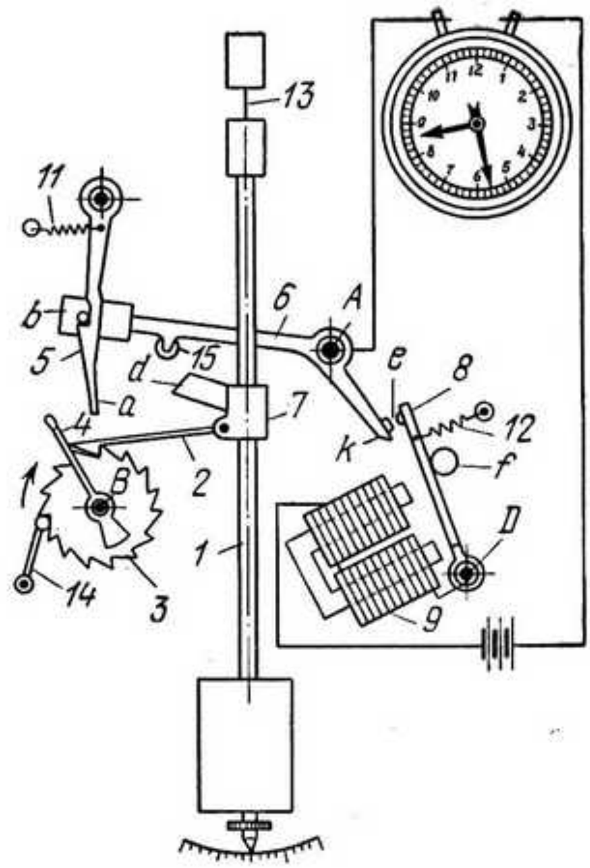
When the winding of electromagnet 1 is periodically energized and de-energized, the electromagnet attracts and releases lever 2, turning about fixed axis A and carrying hinged pawl 3. Pawl 3 turns ratchet wheel 4 clockwise about fixed axis B, winding up a spiral spring (not shown) mounted on the same shaft as the ratchet wheel. Then the winding of electromagnet 5 is periodically energized and de-energized. Electromagnet 5 attracts and releases lever 6, which oscillates about fixed axis C and carries pallets a and b, operating like a double-ended pawl (anchor) with respect to ratchet (escape) wheel 4, which is rotated in the opposite direction by the unwinding spiral spring.

4613	RATCHET-TYPE ELECTROMAGNETIC CLOCK WINDING MECHANISM	TE Dr



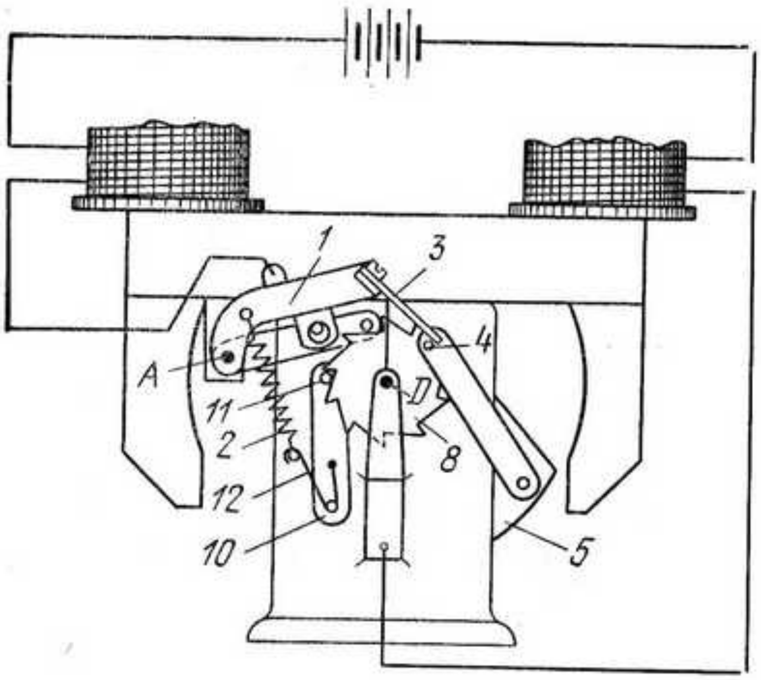
When the spring is wound up, driving lever *1* rotates ratchet wheel *2* counterclockwise about fixed axis *A* by means of pawl *3*, driving the clockwork mechanism. As soon as lever *1* with ratchet wheel *2* turn through a definite angle, cam *b*, mounted at the other end of lever *1*, closes electric contacts *d* and *f*. At this, electromagnet *5* rapidly turns armature *4* counterclockwise about fixed axis *B*. Engaging the end of lever *1*, armature *4* returns driving lever *1* to its initial position, winding up the spring. Pawl *3* is disengaged from ratchet wheel *2*. Pawl *6* prevents rotation of ratchet wheel *2* in the direction of operation of the driving spring. At the end of the motion of lever *1* and armature *4*, liner *e* of insulating material opens contacts *d* and *f*, de-energizing the winding of electromagnet *5*. Armature *4* is returned by spring *7* to its initial position.

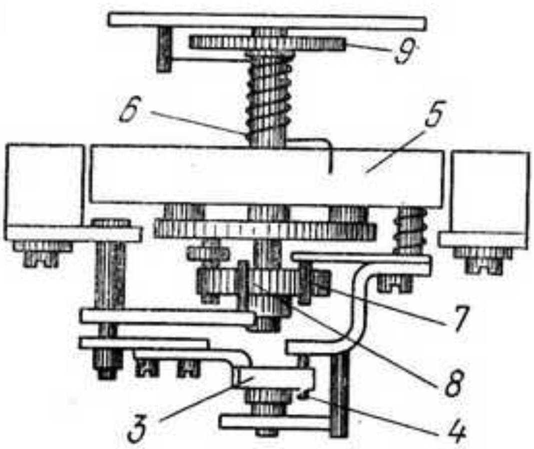
4614	RATCHET-TYPE ELECTRIC CLOCKWORK MECHANISM	TE Dr



As pendulum 1 oscillates, pawl 2, rigidly attached to pendulum 1, rotates ratchet wheel 3, having 15 teeth, clockwise about fixed axis *B*. After each 30 seconds, lever 4, rigidly attached to ratchet wheel 3, engages the end *a* of latch 5. Turning, latch 5 releases weight *b*, mounted on lever 6, which turns about fixed axis *A*. As weight *b* drops, roller 15 rolls down profile *d* of cam 7, rigidly attached to pendulum 1, transmitting a new impulse to the pendulum. Lever 6, turned about axis *A* by falling weight *b*, closes, with its end *k*, the contacts at *e* between armature 8 and lever 6. This energizes the winding of electromagnet 9 and transmits a current pulse to the electric clock. At this, electromagnet 9 attracts armature 8, turning it counterclockwise about fixed axis *D*. Armature 8 engages end *k* of lever 6, turning the lever clockwise and returning weight *b* to its initial position. Spring 11 returns latch 5 to its initial position, opening the contacts at *e* and holding weight *b* in its upper position. Armature 8 is returned by spring 12, when the winding of electromagnet 9 is de-energized, to its initial position against stop *f*. Pendulum 1 is attached to the housing by flat spring (reed) 13. Pawl 14 serves to prevent counterclockwise rotation of ratchet wheel 3.

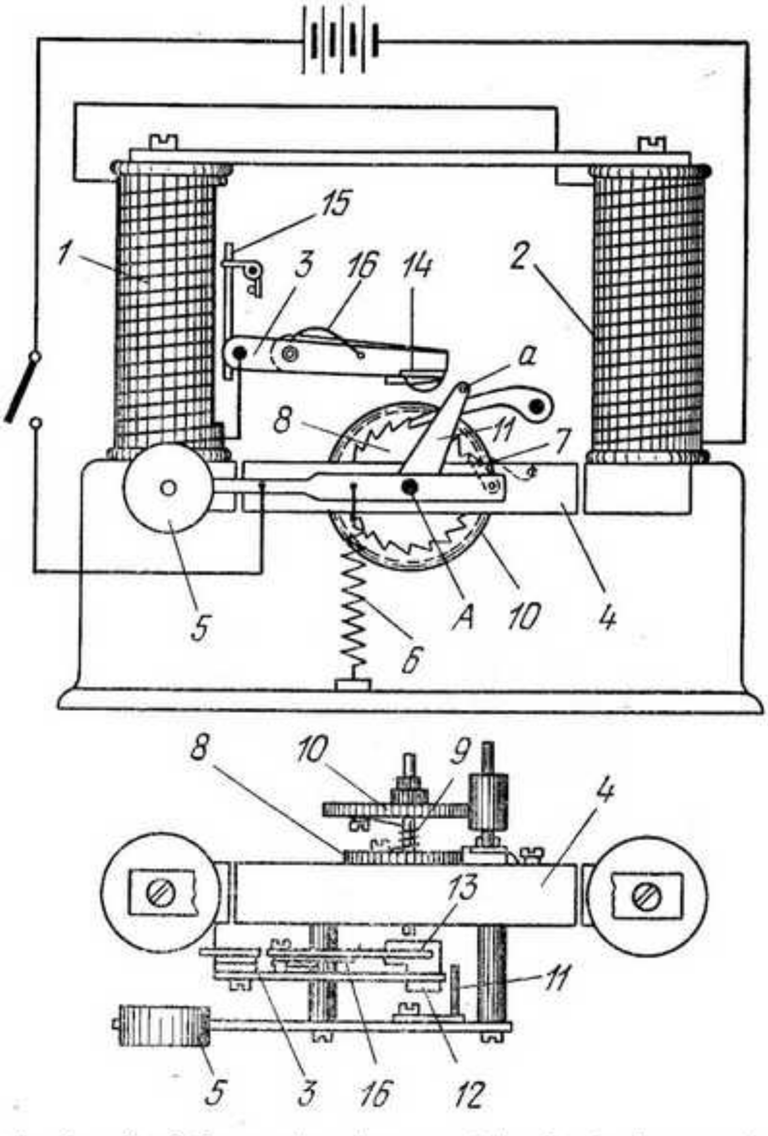
4615 | **RATCHET-TYPE ELECTROMAGNETIC REWINDING MECHANISM** | TE Dr





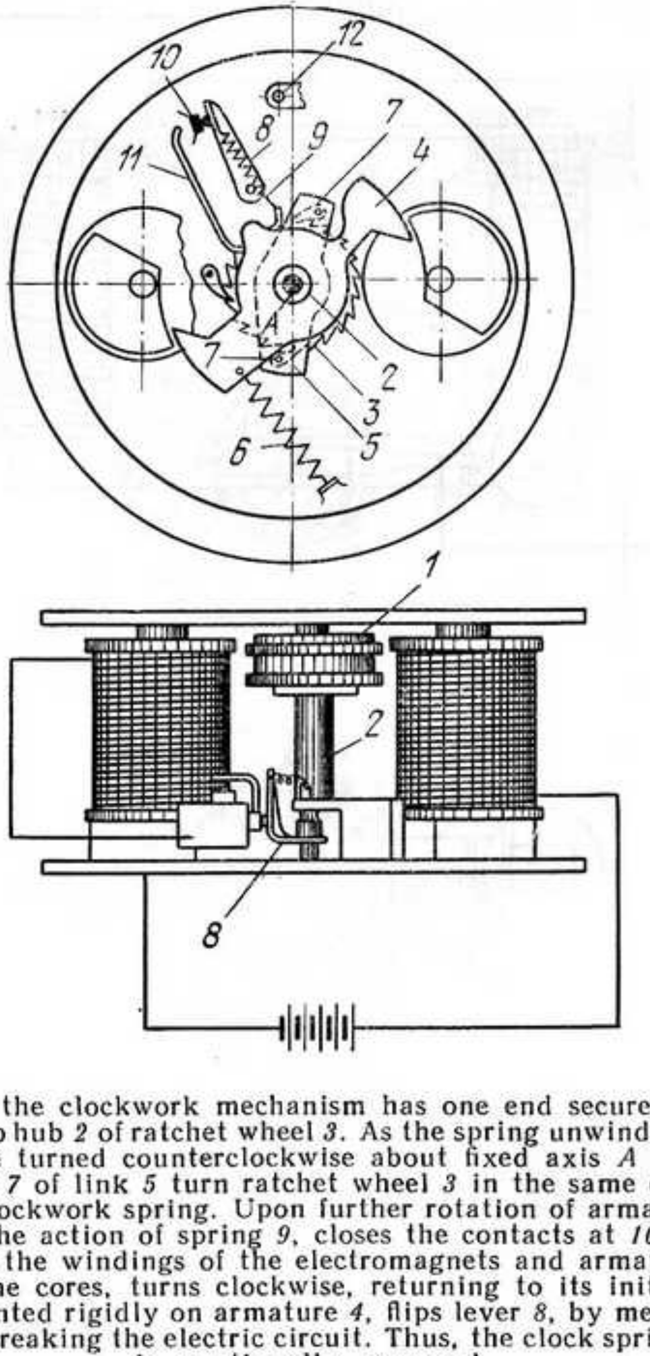
Lever *1*, subject to the action of spring *2*, is turned clockwise about fixed axis *A*, and contact strip *3* makes contact with contact pin *4*, closing the electric circuit of the electromagnet. Armature *5* of the electromagnet is turned counterclockwise about fixed axis *D*. This winds up spring *6* and pin *7* engages the next tooth of ratchet wheel *8*. Since contact pin *4* is retracted from strip *3*, the electric circuit is broken. At this, armature *5* and ratchet wheel *8*, linked to the armature by means of pin *7*, are turned clockwise by spring *6*, and the gearing of the system, linked to ratchet wheel *8* through gear *9*, is subject to a torque pulse. A locking device is provided to ensure that ratchet wheel *8* turns strictly one tooth each time the winding of the electromagnet is energized. This device consists of lever *10* and pin *11*, held against the teeth of ratchet wheel *8* by spring *12*.

4616	RATCHET-TYPE ELECTROMAGNETIC WEIGHTED REWINDING MECHANISM	TE Dr



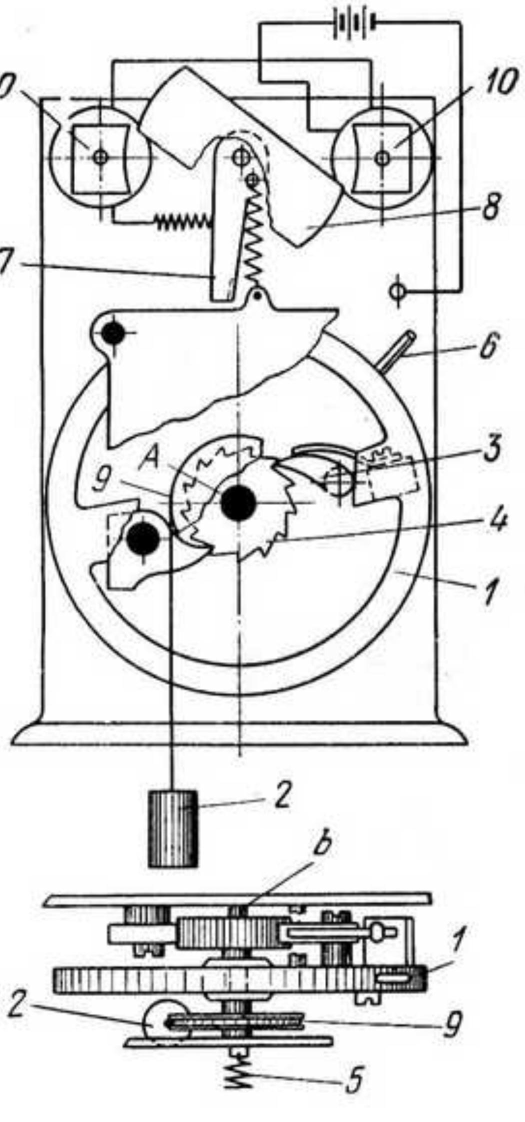
The electric circuit of the mechanism consists of a battery and the series-connected coils, *1* and *2*, of the electromagnets. The free ends of the circuit are connected to lever *3* and to the housing of the mechanism. When the circuit is open, armature *4*, mounted freely on the shaft with axis *A* together with lever *11*, is turned counterclockwise by weight *5* and spring *6* about fixed axis *A*. Pawl *7*, mounted on armature *4*, turns ratchet wheel *8* about axis *A*, winding up spring *9*, which transmits torque to gear *10* of the gearing system of the mechanism. Upon further rotation of armature *4*, contact pin *a* of lever *11* contacts dielectric member *12* and slightly lifts lever *3*. Member *12* is mounted on plate *13* and is pressed by spring *16* against lever *3*. After sliding off member *12*, pin *a* comes into contact with contact pin *14*, closing the electric circuit. Armature *4* returns to its initial position. Lever *3* is insulated from the housing and is held in a definite position by means of spring band *15*.

4617	RATCHET-TYPE ELECTROMAGNETIC REWINDING MECHANISM FOR AN AUTOMOBILE CLOCK	TE Dr



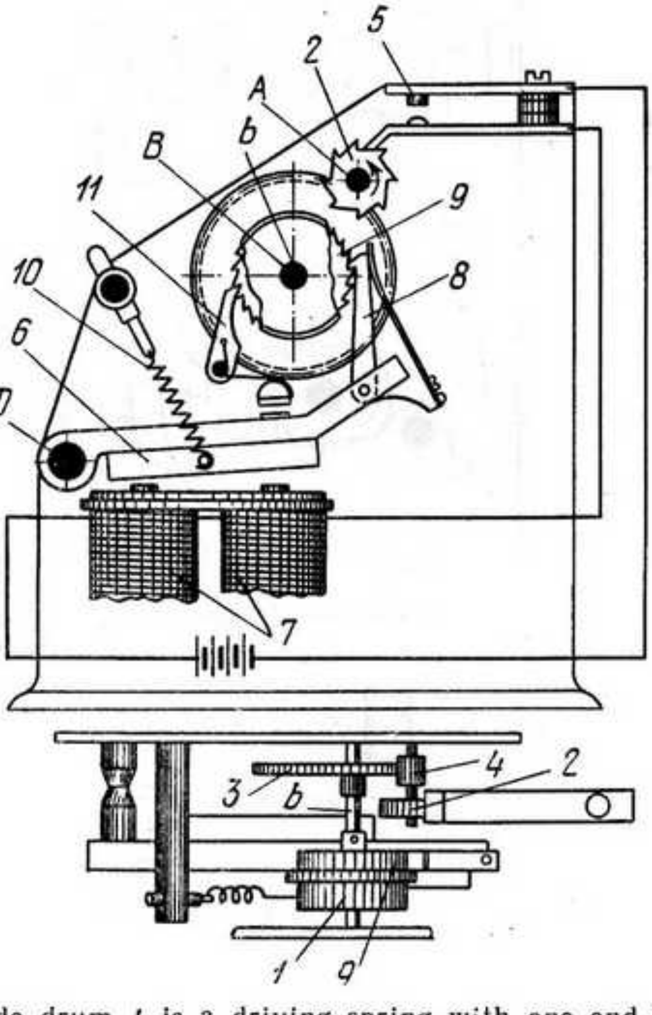
The spring of the clockwork mechanism has one end secured to drum *1* and the other to hub *2* of ratchet wheel *3*. As the spring unwinds, armature *4* and link *5* are turned counterclockwise about fixed axis *A* by spring *6*. At this, pawls *7* of link *5* turn ratchet wheel *3* in the same direction, rewinding the clockwork spring. Upon further rotation of armature *4*, lever *8*, subject to the action of spring *9*, closes the contacts at *10* (as shown). This energizes the windings of the electromagnets and armature *4*, being attracted to the cores, turns clockwise, returning to its initial position. Lever *11*, mounted rigidly on armature *4*, flips lever *8*, by means of spring *9*, to stop *12*, breaking the electric circuit. Thus, the clock spring in drum *1* is continually rewound.

4618	RATCHET-TYPE ELECTROMAGNETIC WEIGHTED REWINDING MECHANISM	TE Dr



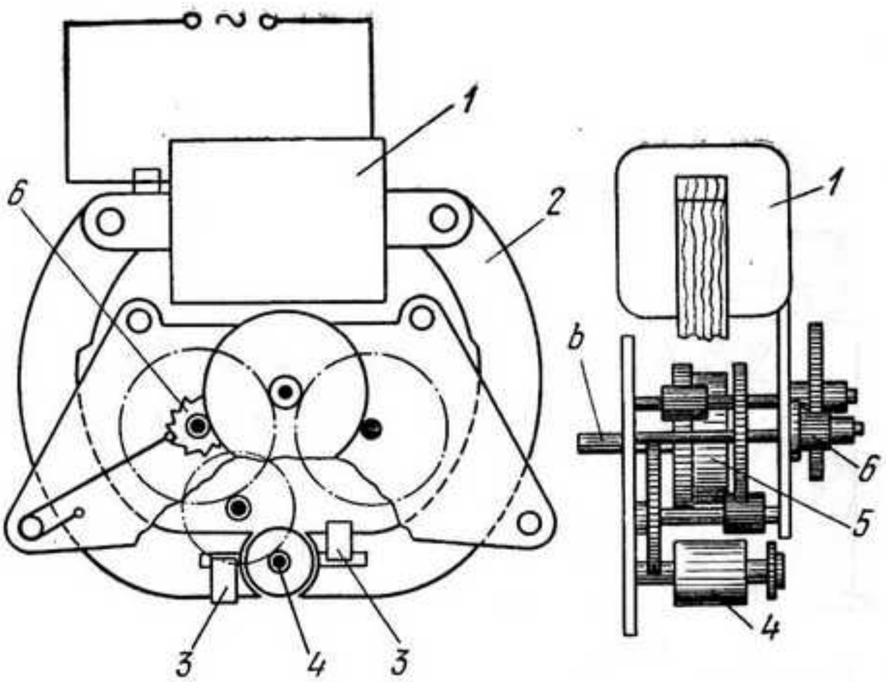
Flywheel *1* is turned counterclockwise about fixed axis *A* by hanging weight *2*. At this, pawl *3* turns ratchet wheel *4*, rigidly mounted on shaft *b*, about axis *A* and spring *5* is wound up. The other end of spring *5* is attached to the input shaft of the instrument. This spring can accumulate only a small reserve of energy and operates as a shock absorber that ensures smoother rotation of the input shaft of the instrument. When contact pin *6* of flywheel *1* reaches contact lever *7*, the circuit of electromagnet *10* is closed and armature *8* turns counterclockwise. At this, lever *7* strikes contact pin *6*, turning flywheel *1* with disk *9* clockwise, raising weight *2*. During this motion, ratchet wheel *4* and shaft *b* remain stationary. Thus, spring *5* is periodically rewound.

4619	RATCHET-TYPE ELECTROMAGNETIC LOG REWINDING MECHANISM	TE Dr



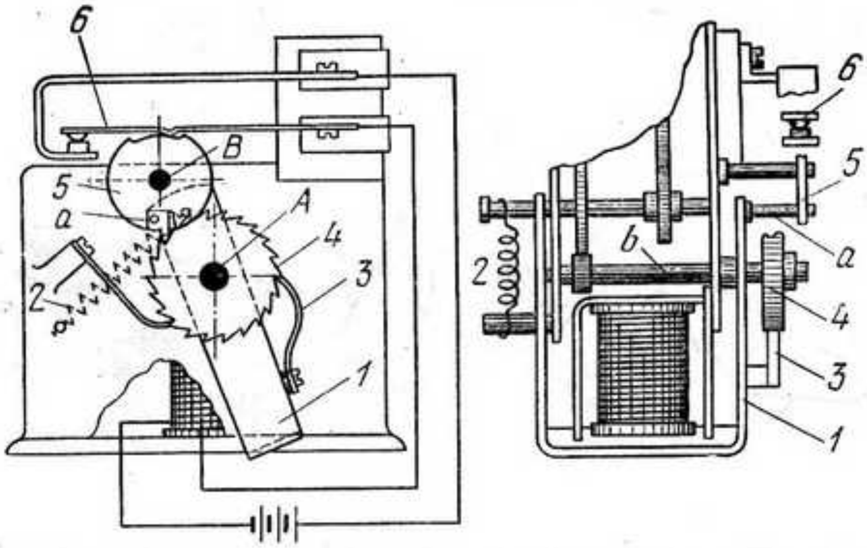
Arranged inside drum *1* is a driving spring with one end secured by a hook to shaft *b*, transmitting rotation to the gearing system of the instrument, and the other end attached to the wall of drum *1*. As the spring unwinds, sprocket *2*, rotated about fixed axis *A* by gears *3* and *4*, periodically closes the contacts at *5* of the electromagnet circuit. At this, armature *6* is attracted to energized coils *7*, connected in series, and pawl *8* turns ratchet wheel *9* clockwise one tooth about fixed axis *B*. Since ratchet wheel *9* is rigidly attached to drum *1*, the driving spring is rewound. When the circuit is broken, armature *6* is turned counterclockwise about fixed axis *D* by spring *10*, retracting it from coils *7* and enabling pawl *8* to engage the next tooth of ratchet wheel *9*. Pawl *11* prevents reverse rotation of ratchet wheel *9*.

4620	GEAR-TYPE SYNCHRONOUS-MOTOR-DRIVEN REWINDING MECHANISM	TE Dr



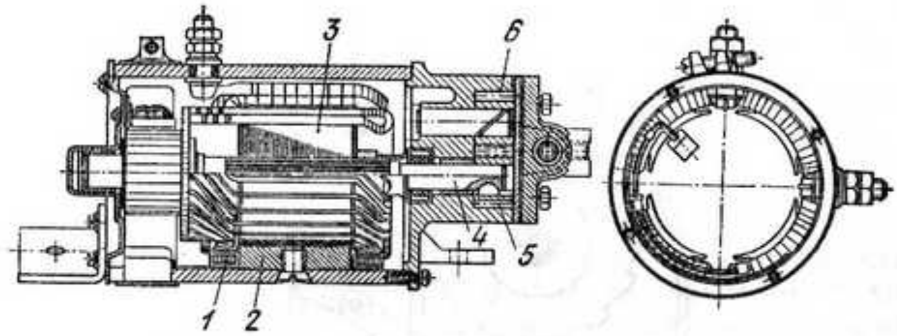
The winding of coil *1* is connected to an a-c power source. Two rings *3* are fitted on the bifurcated poles of stator *2* of the synchronous motor. This provides a phase shift between the magnetic flux of the poles without rings *3* and that of the poles with rings. The result is a rotating field and rotor *4*, located in this field, begins to rotate, gradually reaching the synchronous speed. Through a system of gearing, the rotation of rotor *4* is transmitted to drum *5* in which the spring is enclosed. The wound spring transmits torque to shaft *b*, which, in turn, transmits rotation to the gearing system of the instrument. Detent *6* limits the number of revolutions of drum *5* in winding so as to prevent excess stress in the spring. Shaft *b* rotates at constant torque because motor *2* is constantly included in the circuit. Thus, the spring enclosed in drum *5* is always wound up.

4621 | **RATCHET-TYPE ELECTROMAGNETIC REWINDING MECHANISM** | TE Dr



Spring *2* turns armature *1* counterclockwise about fixed axis *A*. At this, pawl *3* turns ratchet wheel *4* which is rigidly mounted on shaft *b*, transmitting motion to the driven mechanism. Pin *a* of armature *1* bears against disk *5*, turning the disk so that contact strip *6* closes the circuit of the electromagnet. When the winding of the electromagnet is energized, armature *1* is attracted and turns clockwise, tensioning the spring, while disk *5*, turning counterclockwise about fixed axis *B*, opens the contacts and the electromagnet circuit. Since armature *1* is mounted freely on shaft *b* of the gearing system, the torque on shaft *b* drops to zero when armature *1* turns clockwise. Thus, armature *1* periodically tensions spring *2* after it contracts by a definite amount.

GEAR-TYPE ELECTRIC-MOTOR REVERSING MECHANISM



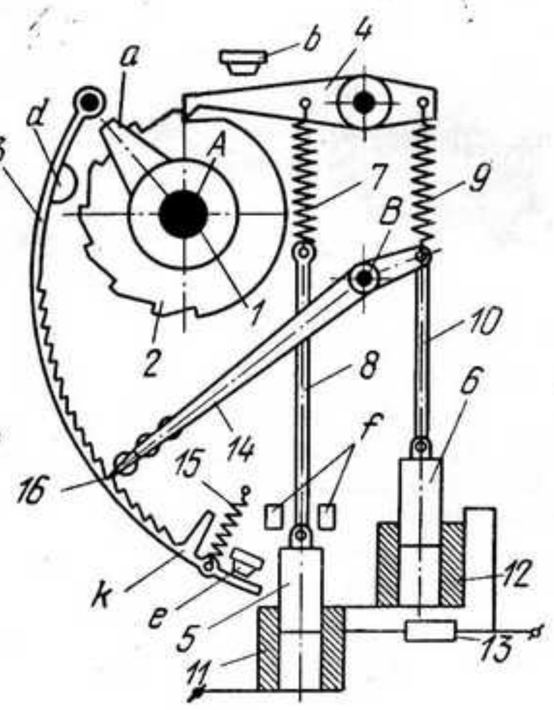
Field coils *1* are wound on four pole shoes *2*, which are secured in the steel housing of the electric motor. When field coils *1* are energized, armature *3* begins to rotate. Armature *3* is rigidly mounted on shaft *4*, which is also the driving shaft of a gear pump. Gear *5* is keyed to shaft *4* and drives gear *6*. The field coils of the motor are connected pairwise. Each pair of coils, connected in series, are wound in opposite directions and have different numbers of turns, comprising two independent field coils. This enables the motor to be reversed by energizing either one or the other coil, using an interlocking reversing relay for this purpose.

4623

ZINOVYEV RATCHET-LEVER ELECTROMAGNETIC AUTOMATIC MOTOR STARTING MECNANISM

TE

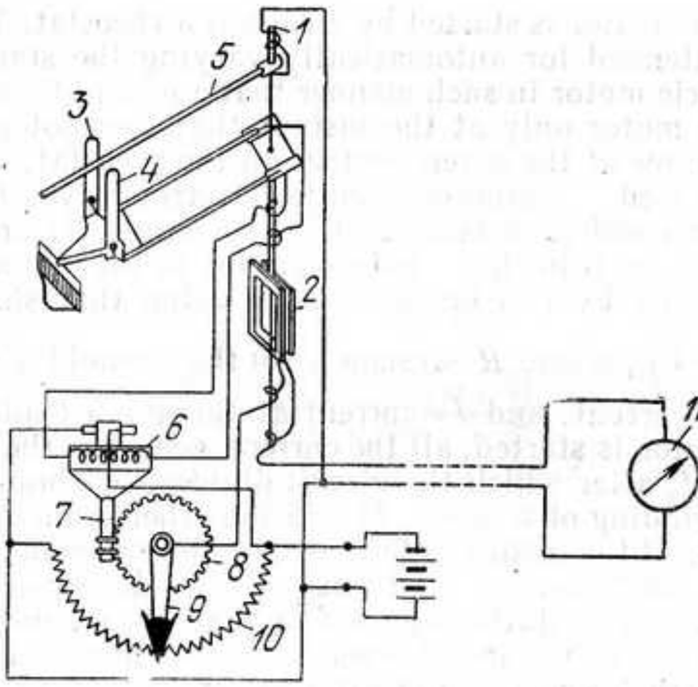
Dr



4623	ZINOVYEV RATCHET-LEVER ELECTROMAGNETIC AUTOMATIC MOTOR STARTING MECHANISM	TE Dr

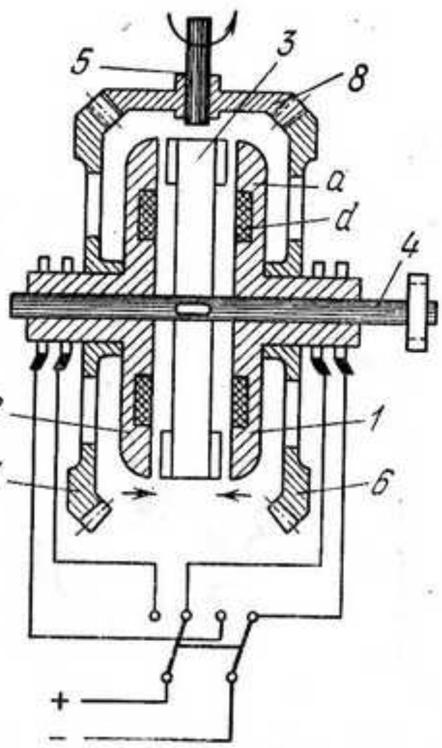
The electric motor is started by means of a rheostat. The mechanism is intended for automatically varying the starting speed of an electric motor in such manner that a new pulse is transmitted to the motor only at the instant that the motor speed has ceased to grow at the given contact on the rheostat, i.e. when it has developed maximum counter-electromotive force. The mechanism consists of two identical solenoids, *11* and *12*, connected in series into the armature circuit of the motor. Solenoid *12* is shunted by resistance *13* of a value that should equal $R\Big/\left(\frac{I_1}{I}-1\right)$, where R=resistance of the solenoid winding, I_1==starting current, and I=current at the given load. When the electric motor is started, all the current energizes the winding of solenoid *11*, after which the circuit divides, one branch energizing the winding of solenoid *12* and the other branch containing resistor *13*. At the initial instant of starting, solenoid *11*, through tie-rod *8* and spring *7*, turns pawl *4* into engagement with ratchet wheel *2*, rotating about fixed axis *A* and mounted rigidly on shaft *1* of the contact lever of the starting rheostat. Pawl *4* locks ratchet wheel *2*, not allowing it to turn further clockwise. At this time, solenoid *12* stretches spring *9* by an amount that turns the end of lever *14* about fixed axis *B* through a certain angle. On its other end, lever *14* has slide block *16*, attached by a flexible strip to the lever. Block *16* slides along toothed arc *3*. With an increase in the motor speed, current I_1 begins to decrease and when this current reaches the value I, spring *9* retracts pawl *4*, enabling ratchet wheel *2* to turn further clockwise, i.e. to transmit a new current pulse to the motor. As the contact lever of the starting rheostat is turned to the next contact, stop *a* of ratchet wheel *2* bears against stop *d* of toothed arc *3*, retracting the arc and releasing lever *14*, which turns to stop *k*. Core *5* is limited by stop *f*, and the whole system returns to its initial position. Arc *3* is always subject to the action of spring *15*, which tends to hold it against stop *e*. Stop *b* limits the angle of rotation of pawl *4*.

4624	LEVER-GEAR ELECTRIC SERVODRIVE MECHANISM	TE Dr



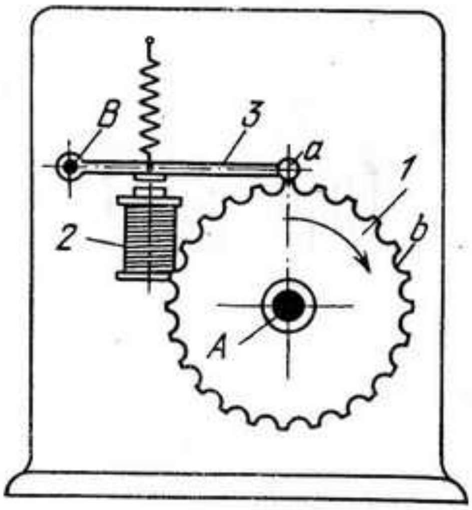
Arranged coaxial to primary measuring instrument *1* is magnetoelectric (moving-coil) device *2*, carrying servocontacts *3* and *4*, between which is hand *5* of measuring instrument *1*. As hand *5* turns to either side, it closes contacts at *3* or *4*. These contacts control motor *6*, linked by meshing worm *7* and worm wheel *8* to slider *9* of rheostat *10*. As slider *9* travels, the current varies in the circuit of magnetoelectric device *2*, leading to deflection of coil *2* and of the servocontact system *3* and *4*, linked to coil *2*. This deflection continues until servomotor *6* is switched off. The established steady current in the line and, therefore, the reading of receiving instrument *11* are proportional to the deflection of hand *5* of measuring instrument *1*, i.e. to the quantity being measured.

4625	FRICTION-GEAR ELECTROMAGNETIC REVERSING CLUTCH MECHANISM	TE C



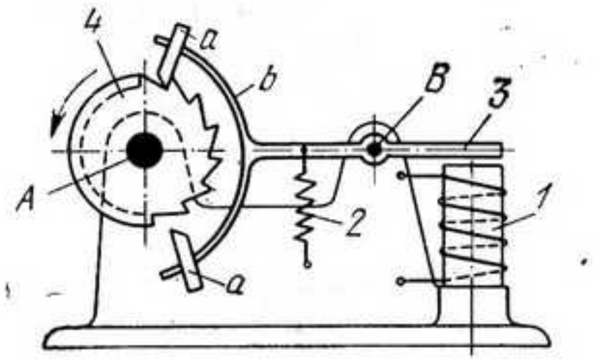
Driven member *3* of the clutch, linked to shaft *4* of the actuating mechanism, is arranged between two driving members, *1* and *2*, each of which consists of iron core *a* with separate winding *d*. Driving members *1* and *2* of the clutch are linked to shaft *5* of the drive motor through bevel gears *6*, *7* and *8*. Hence, members *1* and *2* rotate in opposite directions. To obtain the required direction of rotation of driven shaft *4*, winding *d* of the corresponding driving member of the clutch is energized. When this is done, armature (driven member) *3* is attracted to core *a* of this driving member, thereby linking the driving and driven shafts.

4626	RATCHET-TYPE ELECTROMAGNETIC STOP MECHANISM	TE SD



Toothed wheel *1* rotates about fixed axis A. Armature *3*, turning about fixed axis B, carries pin a, which periodically enters circular slots b of wheel *1*. When the winding of electromagnet *2* is energized, armature *3* is attracted to the core of the electromagnet and its pin a stops rotating wheel *1*.

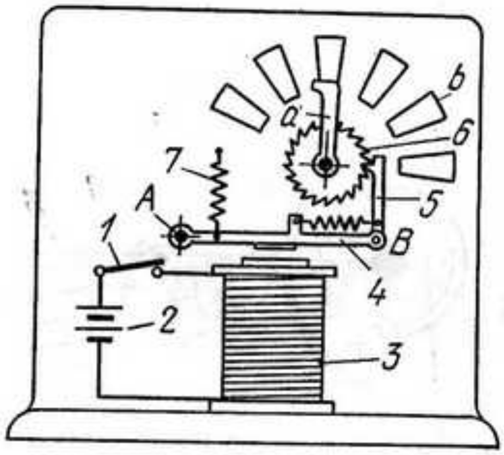
4627	ESCAPEMENT-TYPE ELECTROMAGNETIC STOP MECHANISM	TE SD



Ratchet wheel *4* rotates about fixed axis A. Lever *3* turns about fixed axis B and has fork b with two pallets a. When the coil of electromagnet *1* is energized, the right end of lever *3* is attracted to the core of the electromagnet. When the coil is de-energized, lever *3* is turned counterclockwise by spring *2*. In the oscillation of lever *3*, ratchet wheel *4*, subject to a constant torque, is alternately stopped and released so that it rotates intermittently.

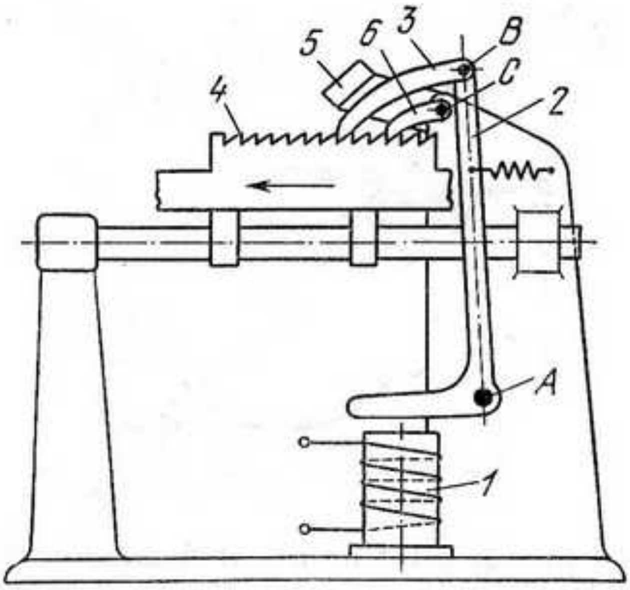
9. MECHANISMS OF OTHER FUNCTIONAL DEVICES (4628 through 4637)

4628	RATCHET-TYPE ELECTROMAGNETIC SELECTOR MECHANISM FOR AN AUTOMATIC EXCHANGE	TE FD



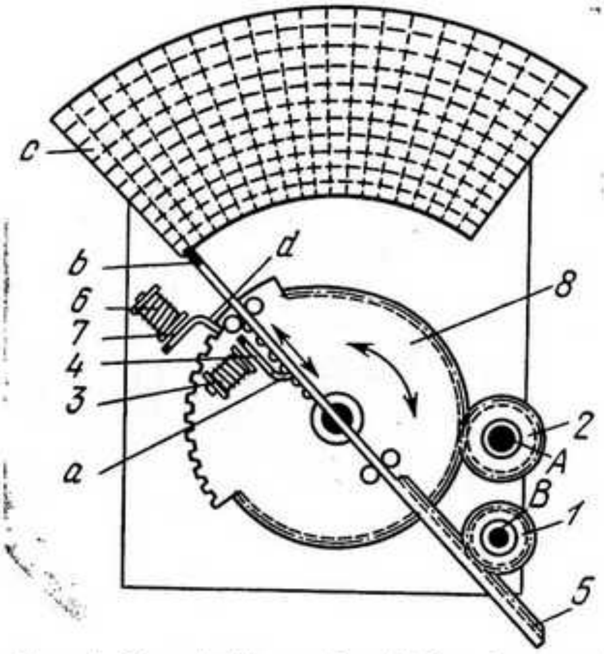
When switch *1* of the circuit with power source *2* is closed, the winding of electromagnet *3* is energized and the core attracts armature *4*, turning it clockwise about fixed axis *A*. At this, pawl *5*, connected by turning pair *B* to armature *4*, engages the next tooth of ratchet wheel *6*. When the circuit is opened, spring *7* retracts armature *4* to its initial position, so that pawl *5* turns ratchet wheel *6* on which brush *a* is mounted. This shifts brush *a* from one contact *b* to the next. As the circuit is repeatedly closed and opened, brush *a* is shifted to the next contact *b*.

4629	**RATCHET-TYPE ELECTROMAGNETIC TRANSLATORY-MOTION SELECTOR MECHANISM FOR AN AUTOMATIC EXCHANGE**	**TE FD**



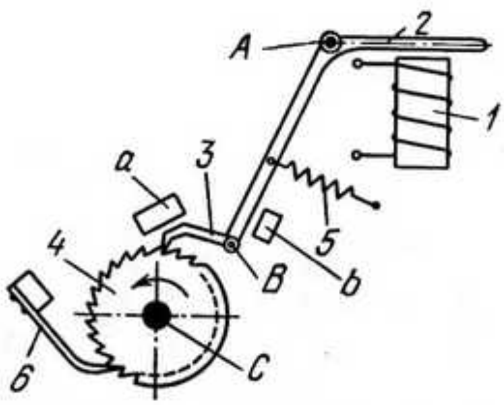
When the winding of electromagnet *1* is energized, it attracts the lower arm of bell-crank lever *2*, turning about fixed axis *A*. Pawl *3*, connected by turning pair *B* to lever *2*, engages a tooth of ratchet-tooth rack *4*, advancing the rack to the left. Stop *5* serves to prevent the rack from being advanced by more than one tooth. Pawl *6*, turning about fixed axis *C*, prevents reverse motion of rack *4*.

4630	RATCHET-TYPE ELECTROMAGNETIC SELECTOR MECHANISM FOR AN AUTOMATIC EXCHANGE	TE FD



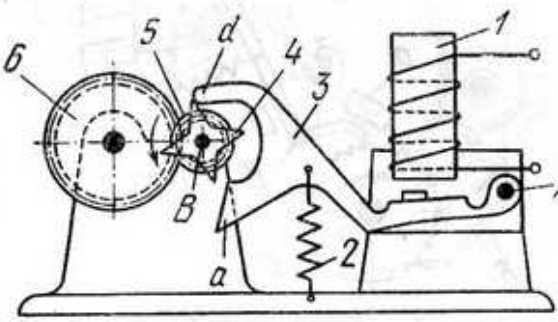
Driving gears *1* and *2*, rotating about fixed axes *B* and *A*, are powered by independent drives. When gear *1* begins to rotate, the winding of electromagnet *3* is energized so that it attracts armature *4*. By means of pawl *a*, mounted on its end, armature *4* detains gear rack *5*, but releases the rack when the armature is attracted by electromagnet *3*. Rack *5* begins to move in a straight line in the direction determined by the direction of rotation of gear *1*. Brush *b*, secured to the end of rack *5*, stops opposite one of the rows of contacts *c*. Upon rotation of gear *2*, the winding of electromagnet *6* is simultaneously energized. This attracts armature *7*, releasing gear *8* from engagement with stop pawl *d*, mounted at the end of armature *7*. Gear *8* begins to rotate in the direction determined by the direction of rotation of gear *2*. Rack *5* turns together with gear *8*. Brush *b* stops at the required column of contacts *c*.

4631	RATCHET-TYPE ELECTROMAGNETIC ROTARY SELECTOR MECHANISM FOR AN AUTOMATIC EXCHANGE	TE FD



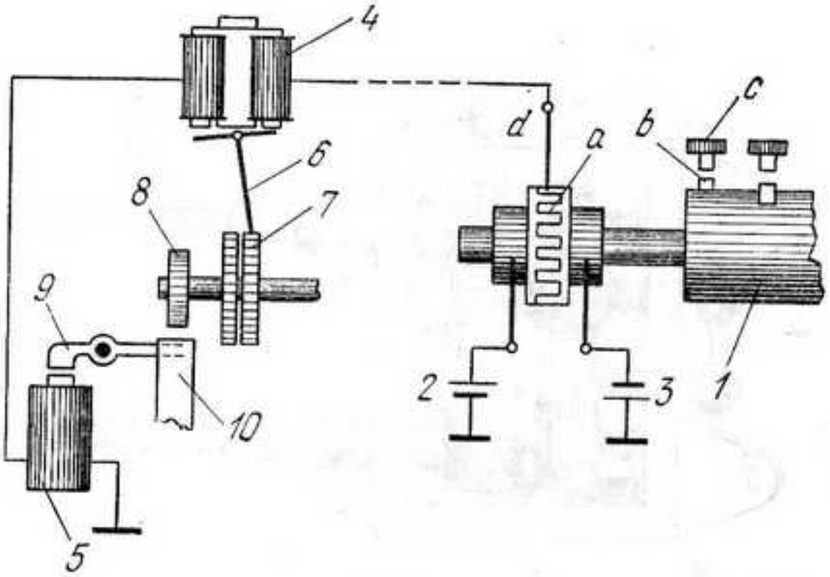
When the winding of electromagnet *1* is energized, the right arm of bell-crank lever *2* is attracted, turning the lever clockwise about fixed axis *A*. Pawl *3*, connected by turning pair *B* to lever *2*, turns ratchet wheel *4* one tooth counterclockwise about fixed axis *C*. Stop *a* prevents ratchet wheel *4* from turning through more than one tooth. Spring *5* returns lever *2* to its initial position, determined by stop *b*. Pawl *6* prevents reverse rotation of ratchet wheel *4*.

4632	RATCHET-TYPE ELECTROMAGNETIC TELEPHONE CONVERSATION COUNTER MECHANISM	TE FD



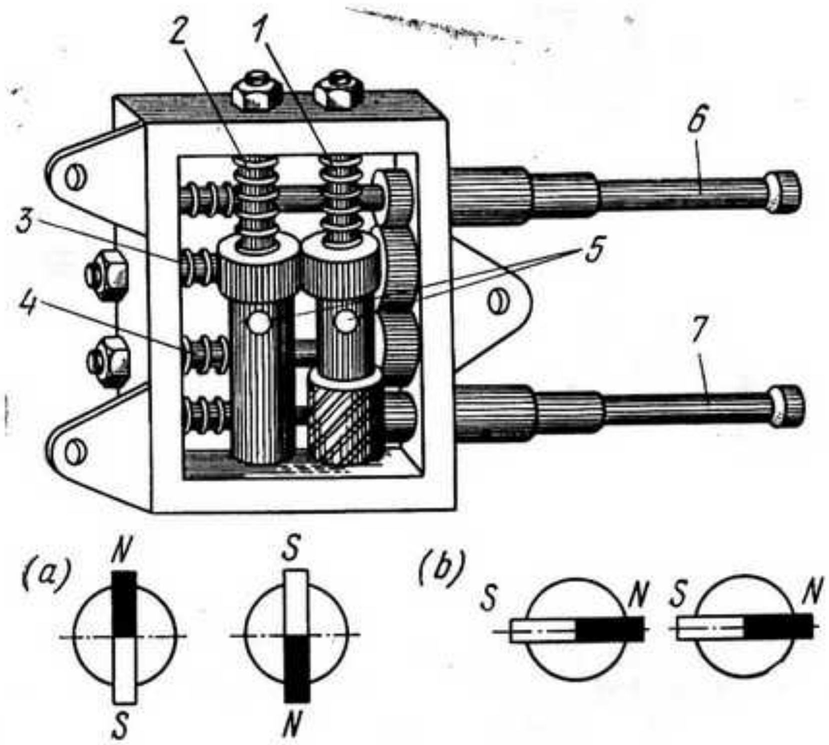
When the winding of electromagnet *1* is energized, the electromagnet attracts and turns lever *3* about fixed axis *A* so that lug *a* turns ratchet wheel *4* counterclockwise about fixed axis *B*. Ratchet wheel *4* turns a geared counting mechanism, linked to the ratchet wheel and including meshing gears *5* and *6*. In the return motion of lever *3*, accomplished by spring *2* when the winding of electromagnet *1* is de-energized, ratchet wheel *4* is turned in the same direction by lug *d* of lever *3*.

4633	ESCAPEMENT-TYPE ELECTROMAGNETIC PRINTING MECHANISM	TE FD



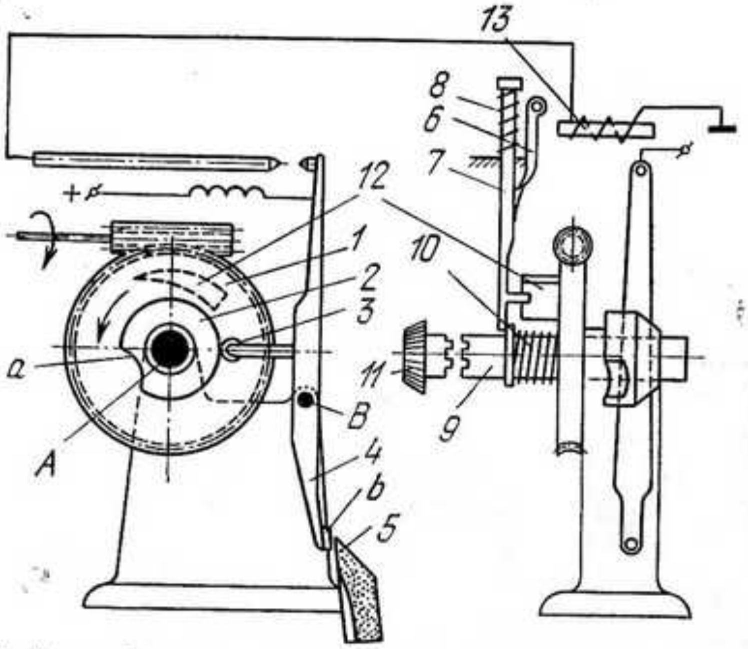
On drum *1*, powered by a friction drive (not shown), pins *b* are secured in a definite order. The number of pins *b* is equal to the number of keys *c*. Rotation of drum *1* is transmitted to commutator *a*, whose halves are insulated from each other and are connected to unlike poles of batteries *2* and *3*. The signals are taken by brush *d* from commutator *a* and transmitted to the line. At the receiving end, the line is connected to polarized selector electromagnet *4* and printing electromagnet *5*. When one of keys *c* is pressed, drum *1* continues uniform rotation until pin *b*, corresponding to the key, is stopped by the key, together with drum *1*. Upon uniform rotation of drum *1*, electromagnet *4* has short current pulses of alternating directions, leading to oscillation of armature *6*, which drives escape wheel *7*. This turns escape wheel *7* and sets printing wheel *8* in a definite position. The long current pulse obtained when drum *1* is stopped energizes the winding of printing electromagnet *5*, which attracts armature *9* and presses paper tape *10* against printing wheel *8*.

4634	GEAR-TYPE MAGNETIC CORRECTOR BOX MECHANISM	TE FD



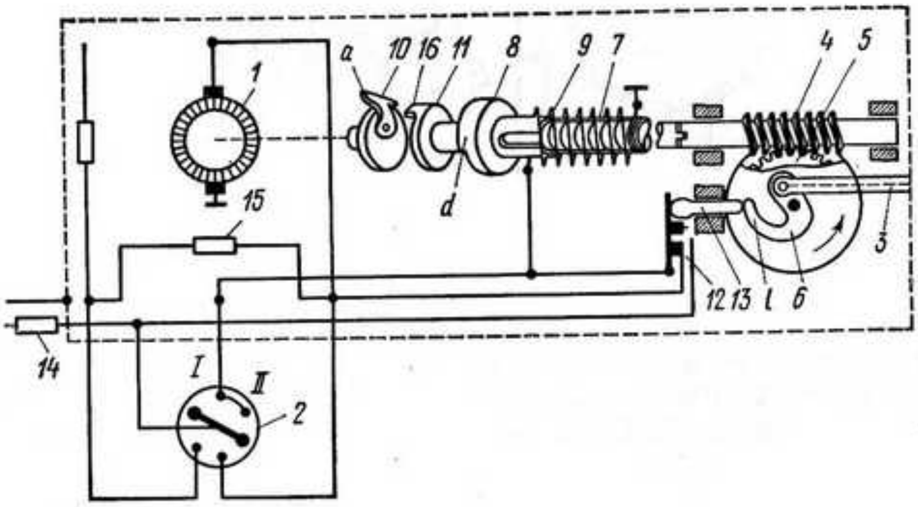
One magnet *5* is inserted into each of the shafts *1*, *2*, *3* and *4*. When shafts *6* and *7* are rotated, the magnets change their positions, and the effect of their magnetic field varies, increasing and decreasing. If the magnets have unlike poles pointing in one direction (Fig. *a*), the magnetic field is minimal. If the magnets are in tandem (Fig. *b*), the magnetic field strength reaches its maximum value. Turning shafts *6* and 7, a position is found for which the deviation of the compass is minimal. The corrector box is placed under the compass card and serves to eliminate the influence of forces produced by magnetized steel components in the vicinity of the compass.

CAM-GEAR ELECTRICAL GRINDING WHEEL WEAR COMPENSATING MECHANISM



Upon rotation of worm wheel *1* about fixed axis *A*, cam *2*, rigidly attached to worm wheel *1*, also rotates and roller *3* of control lever *4*, turning about fixed axis *B*, periodically drops into recess *a* of cam *2*. At the lower end of control lever *4* is diamond tip *b*, which contacts the working face of grinding wheel *5* after definite time intervals. If the working face of the wheel is properly positioned, lever *4* does not switch on the compensating device. Upon wear of the wheel face, lever *4* turns farther and closes an electric circuit, energizing the winding of an electromagnet so that its core *13* attracts lever *6*. This releases rod *7*, which is moved upward by spring *8*. Rod *7* releases clutch member *9*, which is shifted into engagement with bevel gear *11* by spring *10*. At this, wheel *5* is shifted axially to the left by a mechanism (not shown) to compensate for its wear. Continuing to rotate, cam *2* lifts roller *3* out of recess *a* and lever *4* is retracted to its initial position. This breaks the electric circuit, clutch *9* is disengaged and cam member *12* returns rod *7* to its initial position.

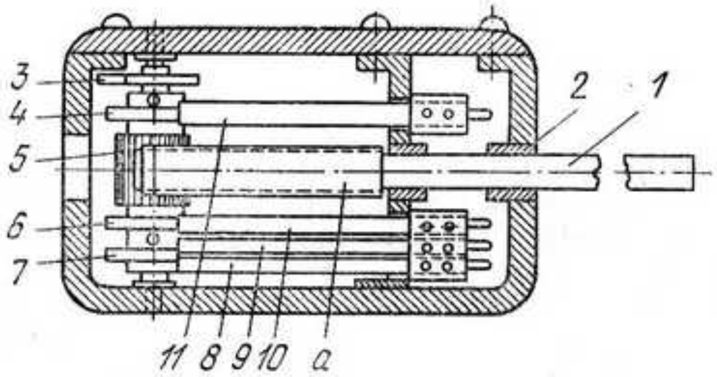
4636	GEAR-TYPE ELECTRIC WINDSHIELD WIPER MECHANISM	TE FD



GEAR-TYPE ELECTRIC WINDSHIELD WIPER MECHANISM

When electric motor *1* is turned on by switch *2*, rod *3*, which drives the wiper blades, begins to reciprocate. Motion is transmitted from motor *1* to rod *3* through a worm reducing gear, consisting of worm *4* and worm wheel *5*. Rigidly mounted on the shaft of worm wheel *5* is crank *6*, connected by a turning pair to rod *3*. Motor *1* is linked to worm *4* through a centrifugal electromagnetic clutch, operating as follows. When electric motor *1* is switched on, the winding of solenoid *7* is energized at the same time. The solenoid pulls in disengaging cylinder *8*, overcoming the resistance of spring *9*. Driving member *10* of the clutch, rigidly linked to the motor shaft, carries hook *a*, which, after the motor has accelerated to a sufficiently high speed, is swung outward by centrifugal force so that hook *a* engages lug *16* of driven member *11* of the clutch, keyed to the shaft of worm *4*. When the motor is switched on in this manner, the system is protected against overloading due to a high starting current and the inertia of rotation of motor *1* helps to start the motion of the wiper blades. The blades are stopped in the same position each time the wiper is switched off by means of limit switch *12*. When the wiper is switched off by switch *2*, there is still current in the motor and in the winding of solenoid 7 from a circuit through the contacts of limit switch *12*. This continues until lug *l* of crank *6* pushes insulated rod *13*, opening the contacts of limit switch *12* and thereby de-energizing the winding of solenoid 7. At this, spring *9* retracts disengaging cylinder *8*, whose lug *d* disengages hook *a* of driving member *10* of the clutch from driven member *11*. This stops worm *4*, worm wheel *5* and the wiper blades. Power is supplied to switch *2* of the windshield wiper through safety fuse *14*. The speed of electric motor *1* is varied by connecting added resistance *15* either into the field circuit (position *I*) or into the armature circuit (position *II*).

4637	CAM-GEAR ELECTRIC-CONTACT SIGNALLING MECHANISM	TE FD

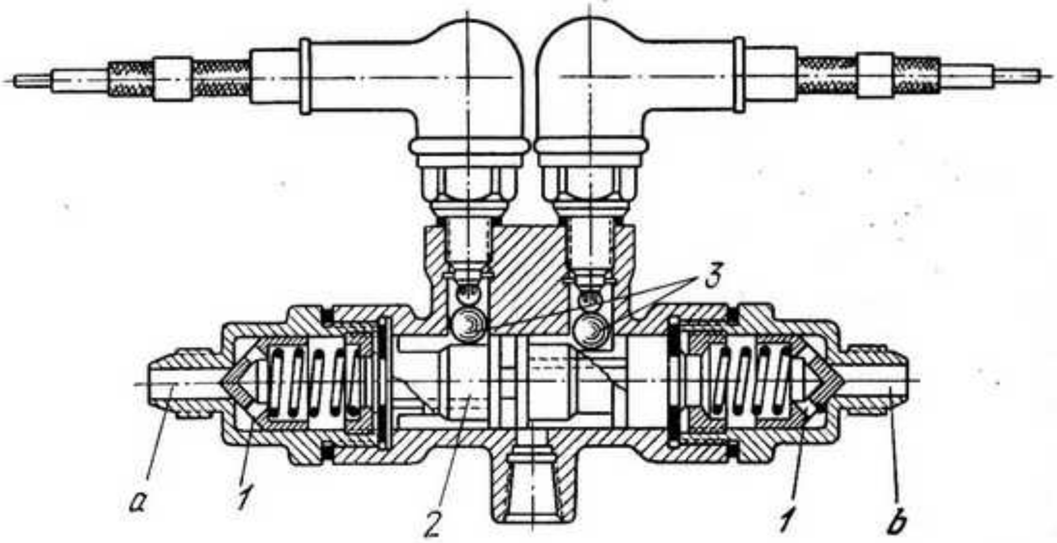


Rod *1*, linked to the machine tool slide and having cylindrical gear rack *a* at its other end, slides in guide bushings *2*. As rod *1* travels, rack *a* rotates pinion *5*. Cams *4*, *6* and *7* are rigidly mounted, together with pinion *5*, on a single shaft. These cams actuate followers *11*, *10*, *9* and *8*, respectively, which close contacts in the circuits of the light signal, sound signal and magnetic starter, thereby signalling that the operation has been finished, and turning off the machine tool. Spiral spring *3* returns the whole system to the initial position.

SECTION THIRTY-SIX

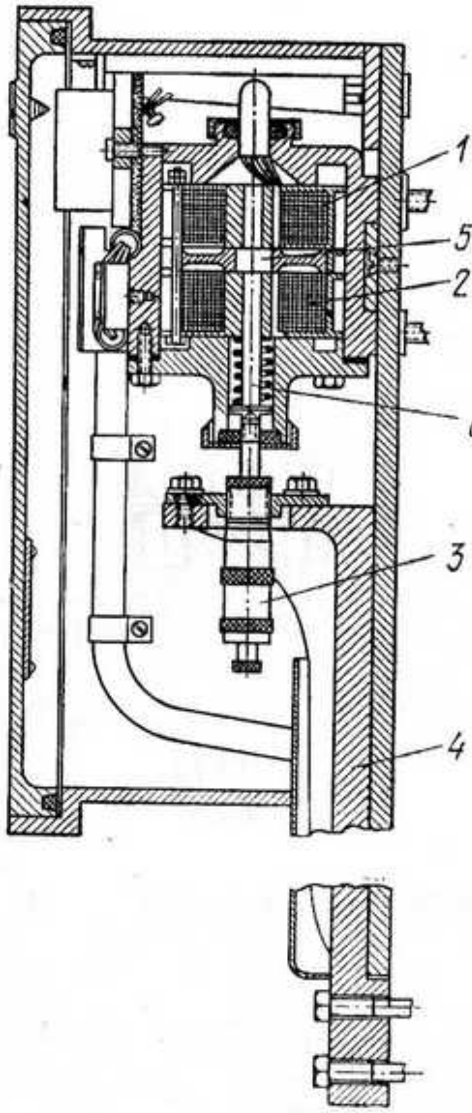
Complex Electric Mechanisms CE

4638	DOUBLE HYDROELECTRIC RELAY MECHANISM FOR SWITCHING ON A LANDING GEAR DRIVE MOTOR	CE Re



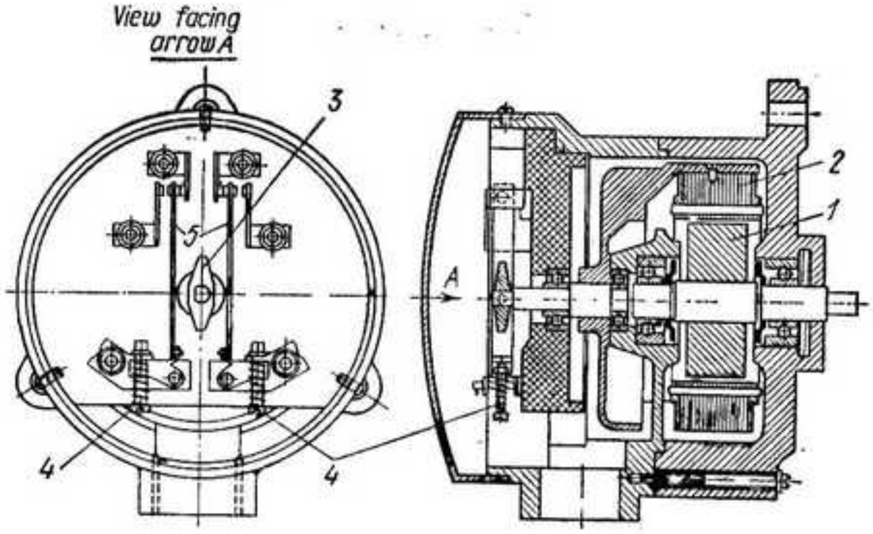
When the pressure increases in port *a* after the landing gear has been fully retracted, or in port *b* after it has been fully lowered, one of valve members *1* is pushed back, admitting the fluid to the left or right end of floating piston 2. The fluid shifts piston 2 and, by means of the corresponding bevel, forces one of steel balls *3*, in a groove of the piston, upward, thereby breaking the supply circuit of the drive electric motor. At the end of the travel of piston 2, second ball *3* drops into the other groove of the piston, closing the circuit that reverses the electric motor.

4639	INDUCTION RELAY MECHANISM	CE Re



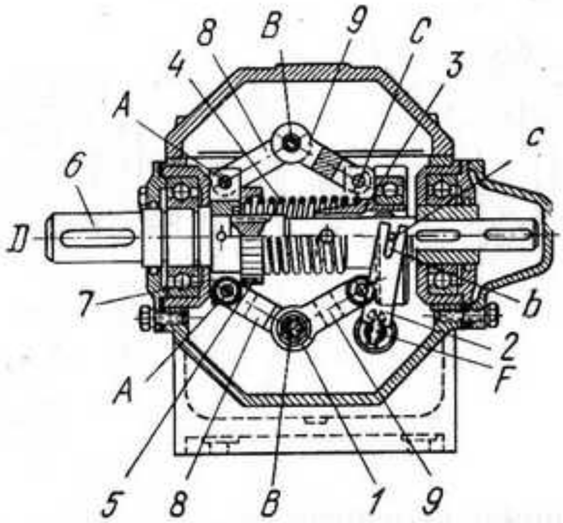
This relay is employed to transmit control signals when the metal enters or leaves the rolls of rolling mills. The relay consists of two coils, *1* and *2*, mounted on separate magnetic circuits with movable armature *5* sliding in the gap between the circuits. The position of armature *5* can be adjusted by micrometer screw *3*, to which shank *6* of armature *5* is held by a spring. Upon relative displacement of the relay housing, rigidly mounted on the upper part of the rolling mill housing, with respect to bracket *4* with micrometer screw *3*, rigidly mounted on the lower part of the rolling mill housing, the clearance between armature *5* and the lower magnetic circuit is reduced and that between armature *5* and the upper magnetic circuit is increased, or vice versa. This changes the inductance of the coils, disturbing the equilibrium of the measuring bridge, and is used to produce the control signal.

4640	ELECTRIC SPEED RELAY MECHANISM	CE Re



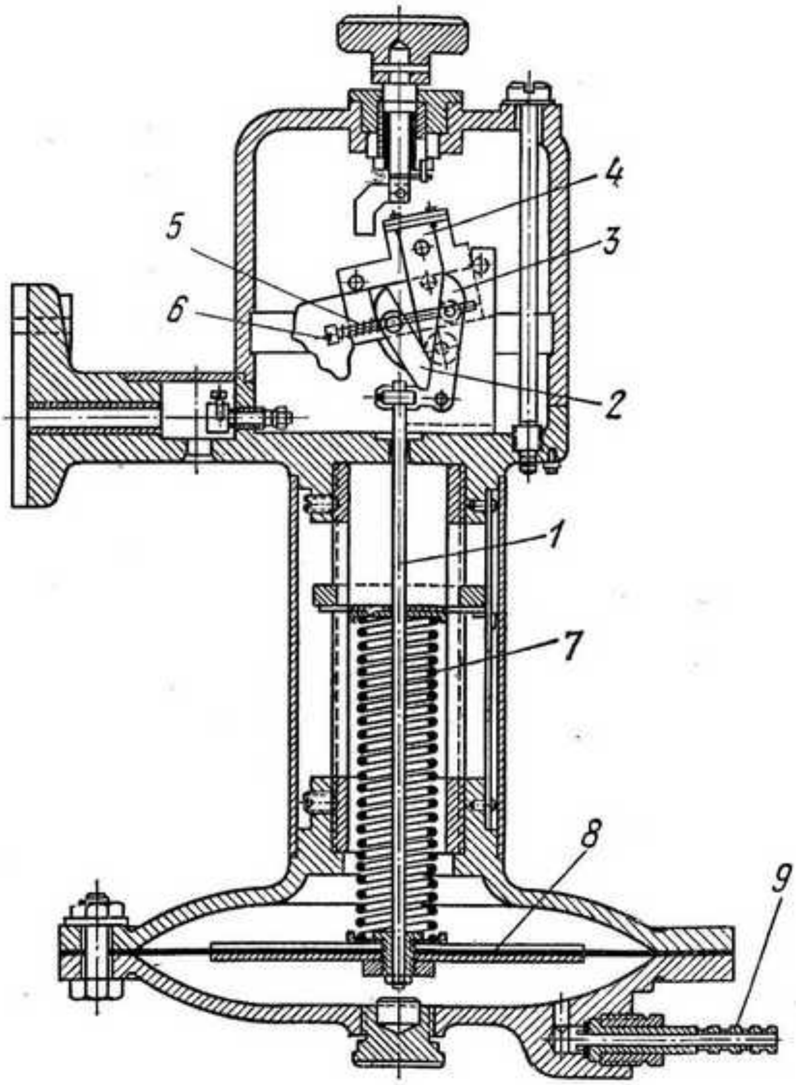
Rotor *1*, an annular permanent magnet, rotates inside stator *2*. The induction of eddy currents in the stator develops a torque which turns stator *2* in the same direction as rotor *1*. This switches over control contacts and electric signals are transmitted to the control system when the shaft being regulated reaches a definite speed. The angular velocity at which the stator of the relay begins to turn is limited by springs *4*. The closing of the contacts is controlled by cam *3*, mounted rigidly on the shaft of stator *2* and actuating spring contacts *5*.

ELECTRIC SPEED RELAY MECHANISM



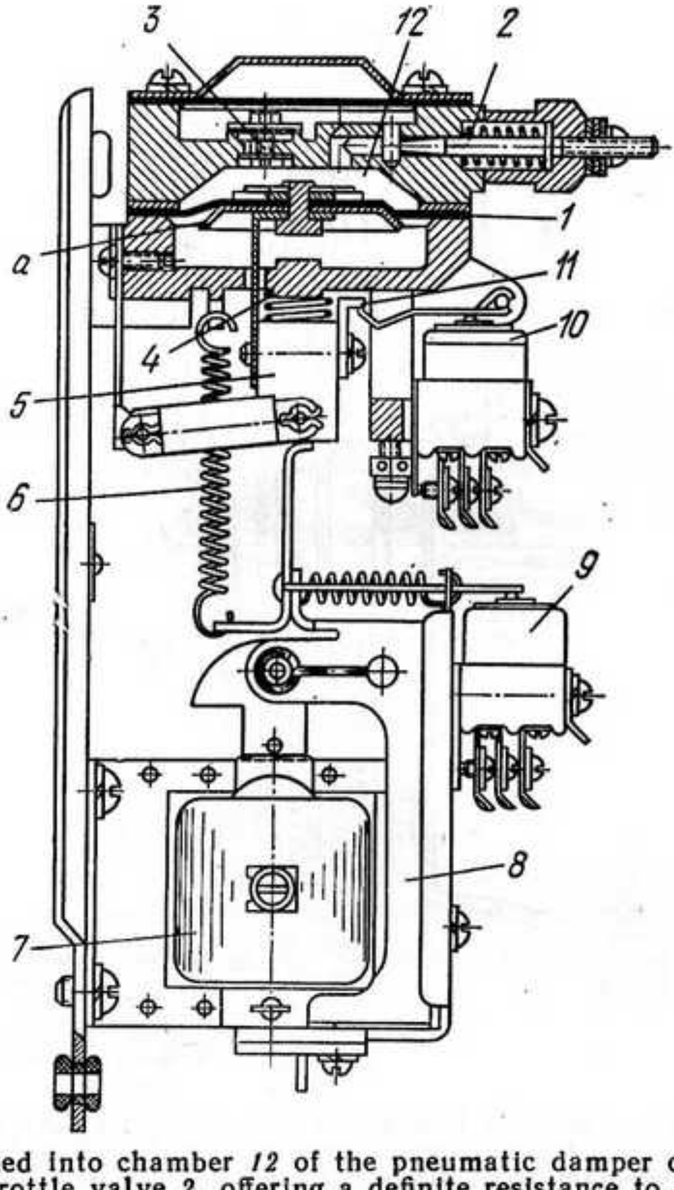
Shaft *6* rotates about fixed axis *D*. Rigidly attached to shaft *6* is crosspiece *7* of a centrifugal governor consisting of links *8* and *9*, connected by turning pairs *A* to crosspiece *7*, by turning pairs *B* to each other and by turning pairs *C* to sleeve *3*. Upon an increase in the speed of shaft *6*, weights *1* are forced outward and sleeve *3* slides to the left along axis *D* of shaft *6*. The contacts switching off the drive of shaft *6* are switched over by pin *c*. Pin *c* slides along slot *b* of lever *2*, which turns about fixed axis *F*. The relay is set up to operate at the specified shaft speed by varying the force exerted by spring *4*, using nut *5* for adjustments.

4642	MERCURY SWITCH PRESSURE-DROP WARNING DEVICE MECHANISM	CE Re



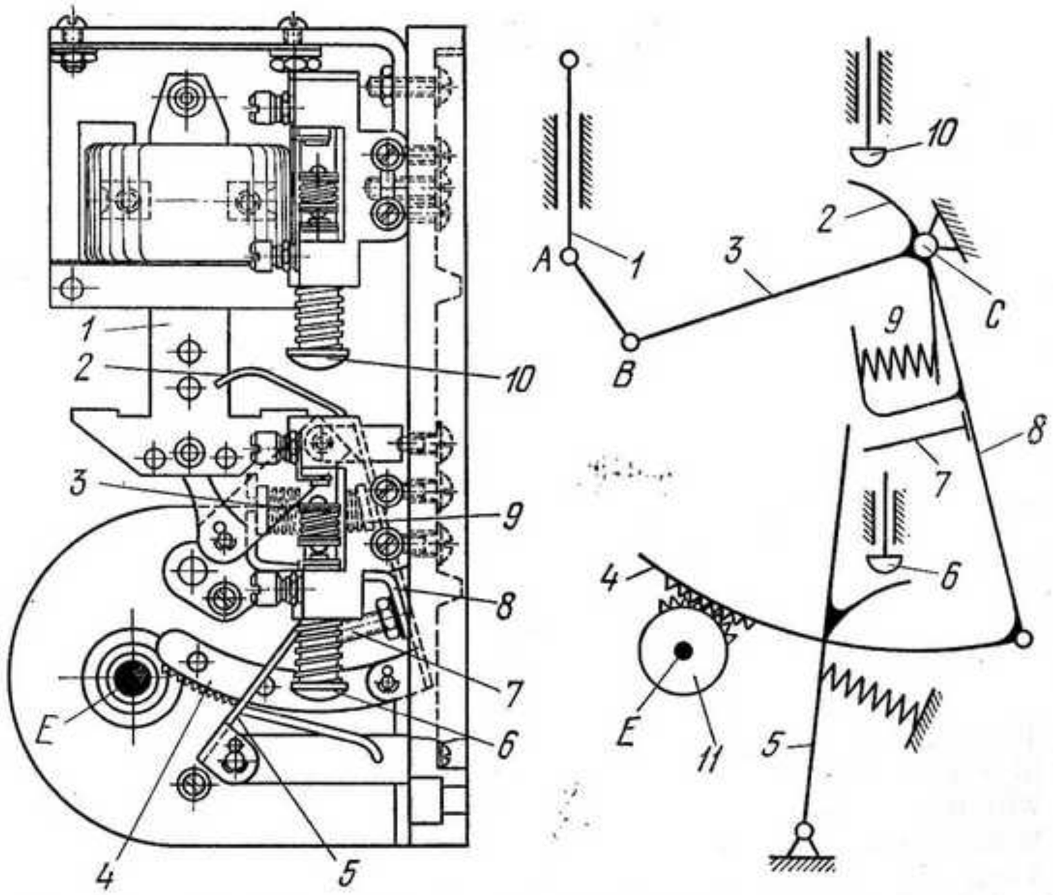
The operating element of the pressure-drop warning device is a housing with membrane *8*. The fluid whose pressure is to be controlled is admitted into the lower chamber of the housing through nozzle *9*. The pressure is counterbalanced by spring *7*, which is adjusted to exert a force corresponding to the lower specified limit of fluid pressure. The sensing element (membrane) is linked by tie-rod *1* to the switching-on and switching-off levers, *3* and *2*, which turn holder *4* of a glass mercury switch. When the fluid pressure drops, lever *3* turns the switch clockwise, closing the corresponding control circuit. When the pressure increases to the normal value, lever *2* turns the switch in the opposite direction, breaking the circuit. Upon a further increase in pressure, after switching off the control circuit, lever *2* can turn with respect to adjusting screw *6* by compressing spring *5*.

4643	ELECTROPNEUMATIC TIME RELAY MECHANISM	CE Re

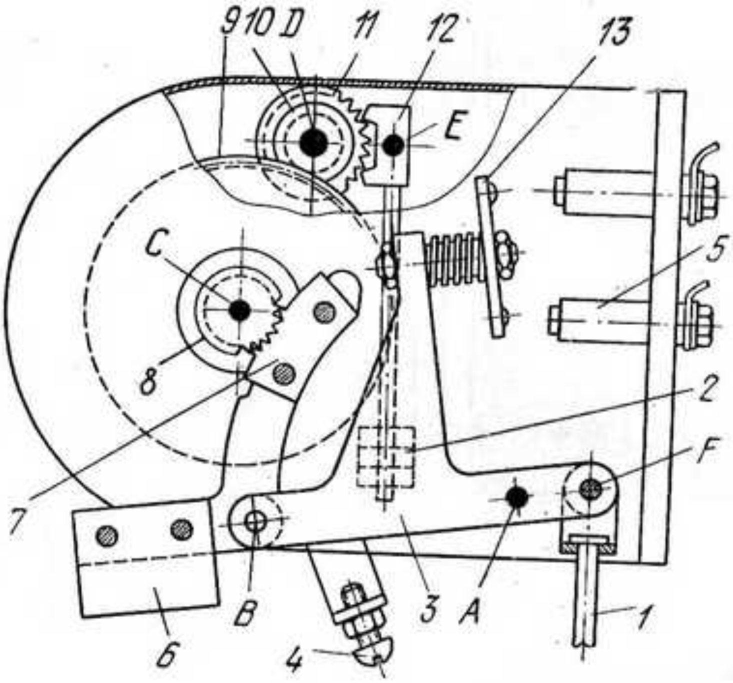


Air is admitted into chamber *12* of the pneumatic damper only through adjustable throttle valve *2*, offering a definite resistance to air flow. Air is freely exhausted from chamber *12* through check valve *3*. The damper is separated from the surrounding space by rubber membrane *1* with rigid mushroom-shaped central member *a*. When coil *7* of the electromagnet is energized, bracket *8*, attached to the armature of the electromagnet, moves downward, away from shoe *5*. Shoe *5* is rigidly attached to member *a* of membrane *1* and is pushed downward by spring *4* at a velocity controlled by the air flow through adjustable throttle valve *2* and the weight of the moving parts. At the end of the downward stroke, stop *11* presses the button of microswitch *10*, which performs the required switching operation. The armature and membrane *1* are returned to the initial position by spring *6* when coil *7* is de-energized. Provision can also be made for instant-action contacts, which are closed when the armature of the electromagnet moves downward.

4644	SOLENOID-OPERATED PENDULUM TIME RELAY MECHANISM	CE Re



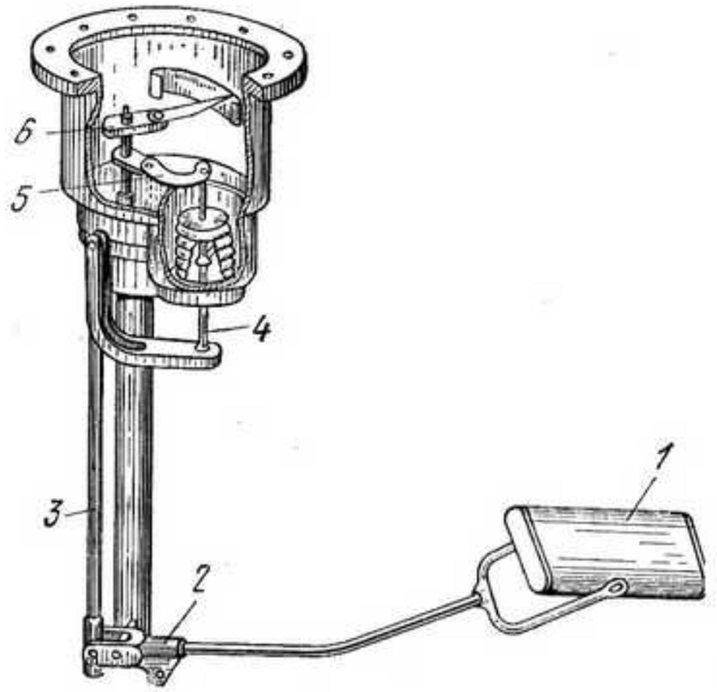
When the solenoid coil is energized and its core *1* is pulled upward, stop *2* on rocker arm *3* pushes button *10* to close instant-action contacts. This also compresses spring *9*, which tends to turn rocker arm *8* clockwise. When segment gear *4*, linked to rocker arm *8*, runs out of mesh with pinion *11*, rotating about fixed axis *E*, screw *7* turns lever *5* counterclockwise. At this, a lug of lever *5* presses button *6*, closing a second set of contacts after the required time delay.



Tie-rod *1* of the relay, linked by a spring to the movable core of a solenoid, is connected by turning pair *F* to rocker arm *3*, which turns about fixed axis *A*. Segment gear *7* is connected by turning pair *B* to rocker arm *3*. When rocker arm *3* turns clockwise, segment gear *7* is held in mesh with pinion *8* by counterweight *6*. Pinion *8* rotates about fixed axis *C*. Gear *9*, rigidly attached to pinion *8*, meshes with pinion *10*, rotating about fixed axis *D*. Escape wheel *11* is rigidly attached to pinion *10*. Double-pallet pawl (anchor) *12* swings about fixed axis *E*. When tie-rod *1* moves downward, rocker arm *3* is turned clockwise and segment gear *7* drives pinion *8*. The speed of rotation of gear *9* depends upon the period of oscillation of anchor *12*, which can be varied by adjusting pendulum weights *2*. After segment gear *7* runs out of mesh with pinion *8*, rocker arm *3* starts to turn rapidly further clockwise and strip *13* closes control contacts *5*. The time delay is regulated by varying the angle of rotation of rocker arm *3* by means of screw *4* and the period of oscillation of anchor *12*.

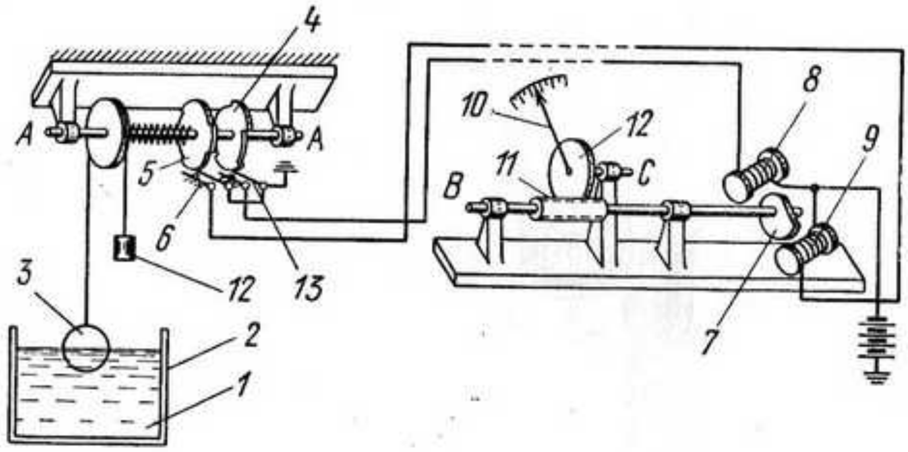
2. MECHANISMS OF MEASURING AND TESTING DEVICES (4646 through 4704)

4646	LEVER-TYPE GASOLINE GAUGE TRANSDUCER MECHANISM	CE M



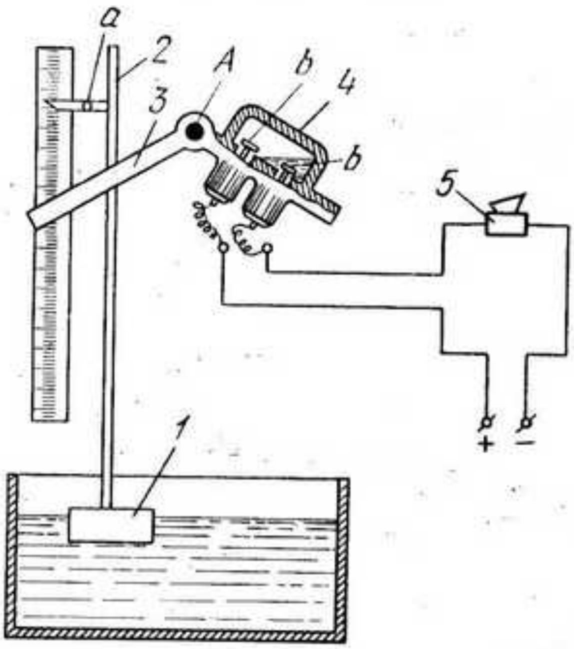
The displacement of float *1* is transmitted by four-bar linkage *2*, *3* and *4* to link *5*, which actuates the slider of potentiometer *6*. The leads of the potentiometer are connected to the gasoline level indicator.

4647	REMOTE-READING LIQUID LEVEL INDICATOR MECHANISM	CE M



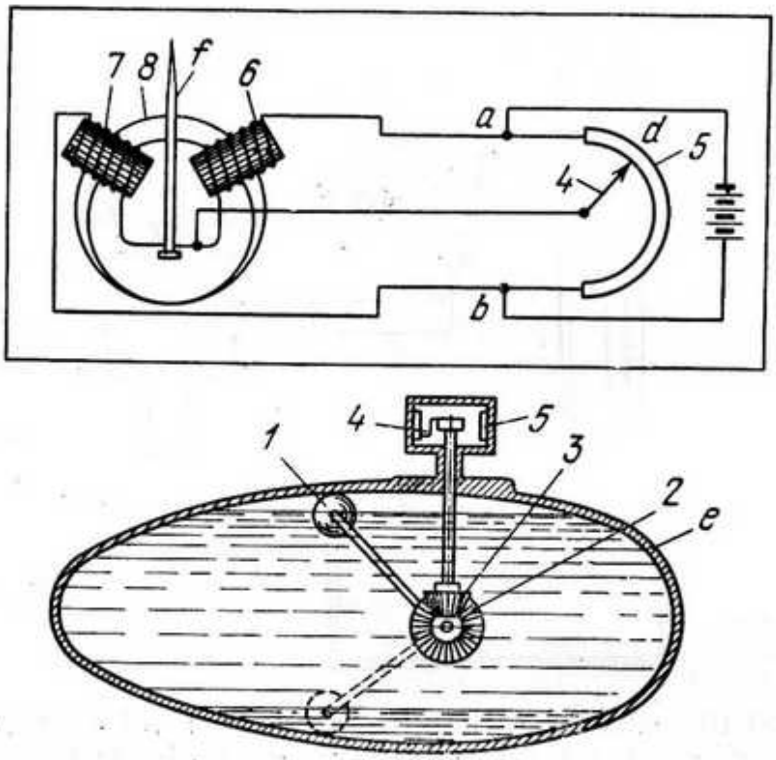
Upon a change in the level of liquid *1* in tank *2*, float *3* is raised or lowered, turning cams *4* and *5* about fixed axis *A*. This closes contacts at *6* or at *13*. The contacting devices are operated alternately upon forward or reverse rotation of cams *4* and *5*. The receiving device contains two electromagnets, *8* and *9*, arranged with an angle of 120° between them. The coils of these electromagnets are alternately energized and they turn armature *7* in one or the other direction about fixed axis *B*. This rotation is transmitted through worm *11* and worm wheel *12* to hand *10*, which turns about fixed axis *C*.

4648	MERCURY-SWITCH LOWEST LIQUID LEVEL REMOTE-SIGNALLING MECHANISM	CE M



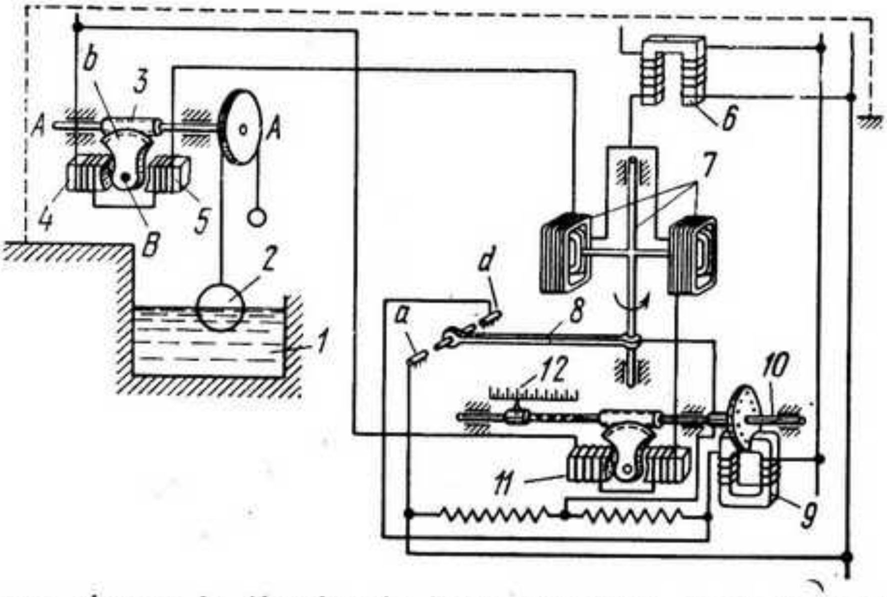
Float *1*, at the surface of the liquid whose level is being controlled, has level indicator *2* sliding along a scale. At a permissible level, indicator *2* is above bell-crank lever *3*, which turns about fixed axis *A* and carries glass vessel *4*. The vessel contains two contacts *b* that can be closed by mercury. When the liquid level drops below the permissible value, pin *a* of indicator *2* turns lever *3* about axis *A*. This closes contacts *b*, switching on signalling device *5*.

4649	FLOAT-TYPE ELECTRIC GASOLINE GAUGE MECHANISM	CE M



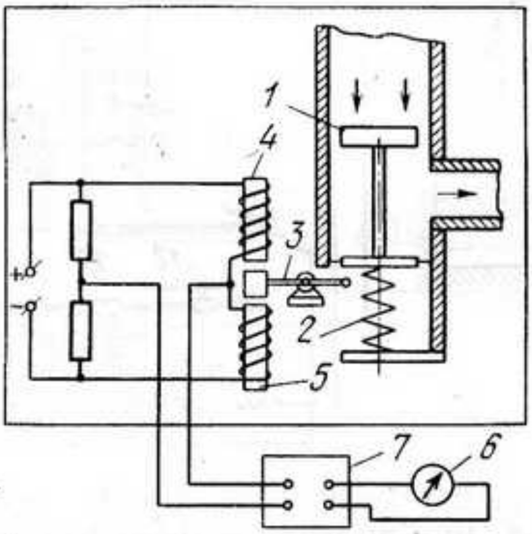
When the level of the gasoline in tank *e* changes, the displacement of float *1* is transmitted by bevel gears *2* and *3* to slider *4*, which slides along the winding of potentiometer *5*. As this takes place, the voltage between points *a* and *d*, and *d* and *b* varies continuously, and each position of float *1* in tank *e* corresponds to a definite ratio of voltages of the currents energizing electromagnet coils *6* and *7*, arranged with an angle of 120° between them. Moving in coils *6* and *7* is crescent-shaped iron core *8* to which hand *f* is rigidly attached. Depending upon the position of slider *4* in potentiometer *5*, the currents in coils *6* and *7* vary and set up varying magnetic fields that turn core *8*. Hand *f* indicates the volume of gasoline in tank *e*. Since gasoline tanks are of irregular shape, the instrument must be calibrated for the given shape.

4650	REMOTE-READING LIQUID LEVEL INDICATOR MECHANISM	CE M



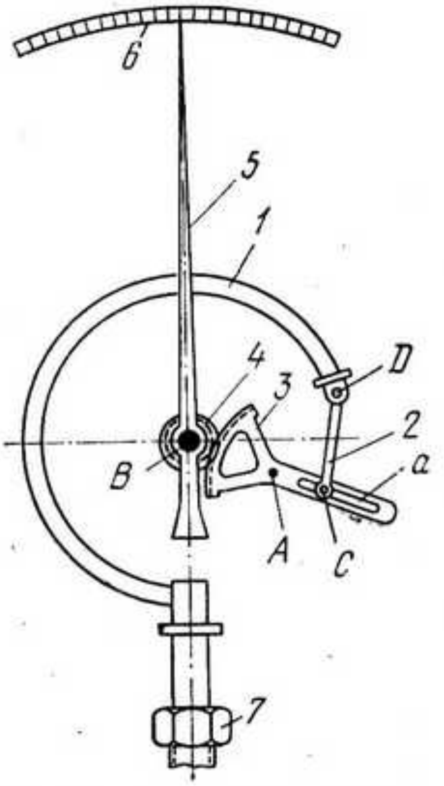
Upon a change in the level of the liquid in tank *1*, float *2* is raised or lowered, turning worm *3* about fixed axis *A*. Worm *3* meshes with segment worm wheel *b* and turns it about fixed axis *B*, displacing core *4* of reactance coil *5*. This changes the current in coil *5*, thereby disturbing the equilibrium of electrodynamic balance *7* at the receiving end. By means of contact lever *8*, rigidly mounted on the turning member of electrodynamic balance *7*, one of the two pairs of contacts at *a* or *d* is closed, starting motor *9* with rotation in one or the other direction. At this, motor *9*, by means of shaft *10* and worm gearing, displaces the core of inductance coil *11*, thereby changing the current at the receiving end until electrodynamic balance *7* is again in equilibrium and lever *8* oscillates freely between contacts *a* and *d*. The transmission to the core of coil *11* has a threaded sleeve with an indicator hand that moves along thread on shaft *10*. The hand slides along scale *12*, on which the position of the core and, consequently, that of float *2* can be read off. Intermediate transformer *6* serves to ground one winding of electrodynamic balance *7*.

4651	INDUCTION-TYPE FLOW GAUGE MECHANISM	CE M



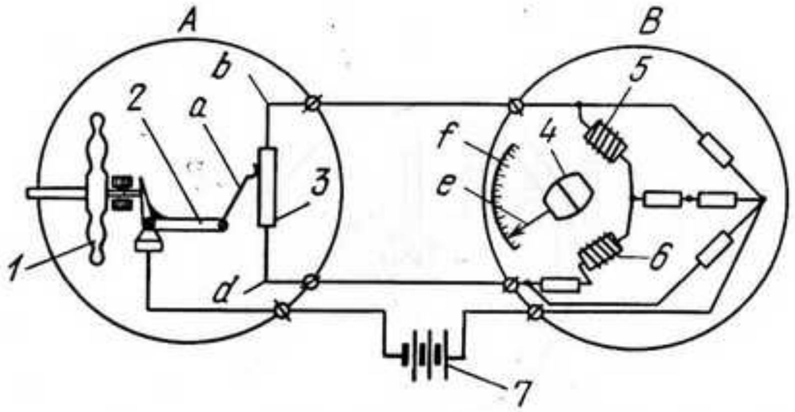
Body *1* is placed in the stream of liquid whose flow rate is to be measured. As the liquid flows around body *1*, the force exerted on the body is proportional to the square of the velocity of the stream. If this force is balanced by that exerted by spring *2*, the spring is compressed by different amounts at different stream velocities and, consequently, at different rates of flow. Therefore, the amount spring *2* is compressed is an indication of the flow rate. Displacement of body *1* is transmitted to armature *3*, which changes the coefficient of self-induction of coils *4* and *5*. This is indicated by measuring instrument *6*, which is connected to the circuit through amplifier *7*.

4652	ELECTRIC-CONTACT PRESSURE GAUGE MECHANISM	CE M



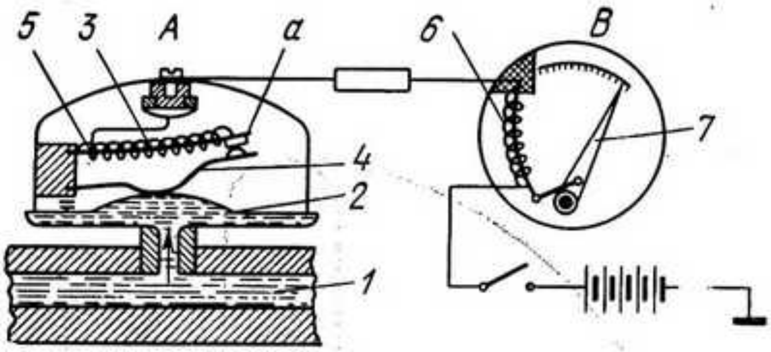
Link *2* is connected by turning pair *D* to Bourdon tube *1*, into which fluid (gas or liquid) under pressure is admitted through connection *7*. Pin *C* of link *2* slides along slot *a* of segment gear *3*, turning about fixed axis *A*. Segment gear *3* meshes with pinion *4*, turning about fixed axis *B* and rigidly attached to hand *5*. When the pressure in Bourdon tube *1* increases, it begins to straighten out and the displacement of its sealed end is transmitted to hand *5*. Hand *5* consecutively closes a series of contacts *6*, each contact corresponding to a definite pressure.

4653	UNIFIED REMOTE-READING ELECTRIC PRESSURE GAUGE MECHANISM	CE M



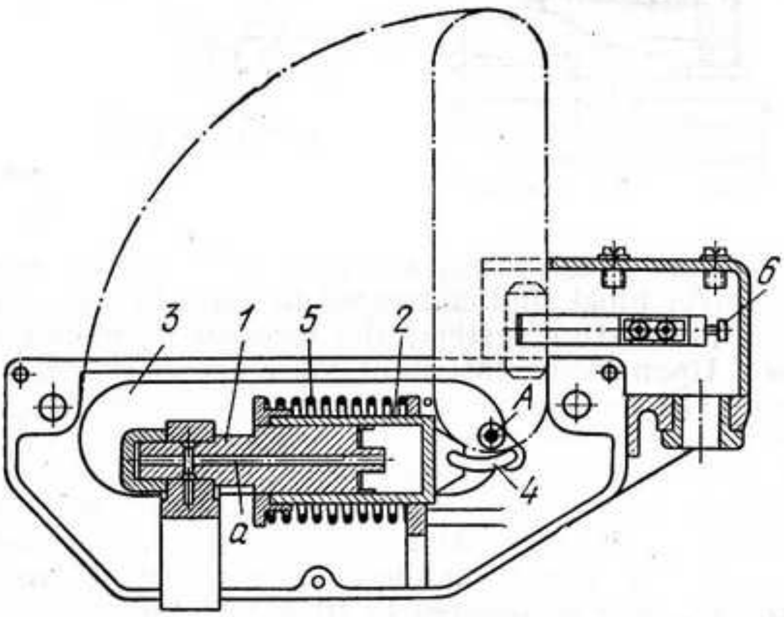
The pressure gauge consists of pressure detector *A* and pressure indicator *B*, connected together by electric wiring. The variable pressure line or vessel is connected to the sensing element which constitutes membrane box *1*. With an increase in pressure, box *1* spreads and, by means of lever *2*, displaces contact *a*, which slides along rheostat *3*. This increases the electrical resistance between points *b* and *a* and reduces that between points *a* and *d*. The ratio of the resistances of sections *ab* and *ad* of rheostat *3* is measured by a logometer with movable permanent magnet *4*, turning in the magnetic field set up by coils *5* and *6*, arranged at an angle of 120° to each other. Coils *5* and *6* are connected into a symmetrical bridge circuit. When power source *7* is connected to the diagonal of the bridge, the ratio of the currents in coils *5* and *6* of the logometer depends on the pressure being measured, which is indicated by hand *e* on scale *f*.

4654	THERMOPULSE PRESSURE GAUGE MECHANISM FOR INDICATING OIL PRESSURE IN AN AUTOMOBILE LUBRICATING SYSTEM	CE M



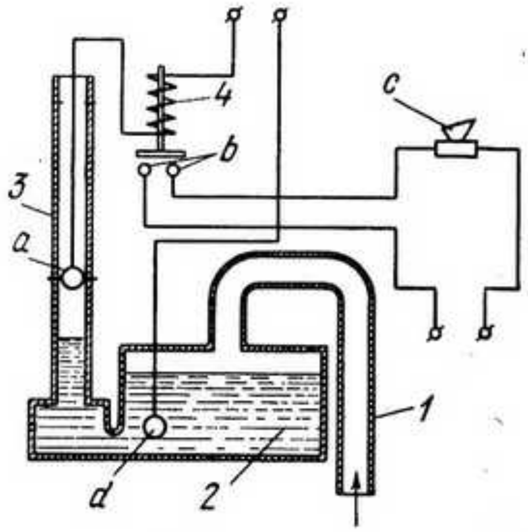
The oil pressure gauge consists of pickup A, screwed into a hole in the cylinder block and connected to main lubricant line 1 of the engine lubricating system, and receiver B, mounted on the dashboard. Upon an increase in pressure in lubricating system 1, diaphragm 2 of the pickup is bent upward so that it pushes the bulge of strip 4 to close the contacts at a. This closes a circuit whose current energizes winding 3, heating bimetallic strip 5 of the pickup. This circuit includes the winding of the receiver, having the same current. Bimetallic strip 5 of the pickup with winding 3 is insulated from the chassis, or frame ground. One end of the winding is soldered to strip 5 at the contact and the other is connected to the winding of bimetallic strip 6 in the receiver. When strip 5 of the pickup is heated, it bends upward and opens the contacts at a. At this, strip 5 cools and straightens out, closing the contacts again. The frequency with which the contacts at a are opened and closed, and, consequently, the length of the current pulse in the receiver depend both on the heating of strip 5 by the current and on the pressure in lubricating system 1 of the engine that actuates diaphragm 2. The higher the oil pressure, the more diaphragm 2 bends upward and the greater the force pressing the contacts at a together. Hence, with an increase in pressure in lubricating system 1, it will take a longer current pulse to heat bimetallic strip 5 so that it bends a sufficient amount to open the contacts at a. Thus, the length of the current pulses increases with the pressure. This, in turn, increases the amount that bimetallic strip 6 of the receiver is bent, thereby increasing the deflection of hand 7.

4655	ELECTRIC-SWITCH PRESSURE-DROP WARNING DEVICE MECHANISM	CE M



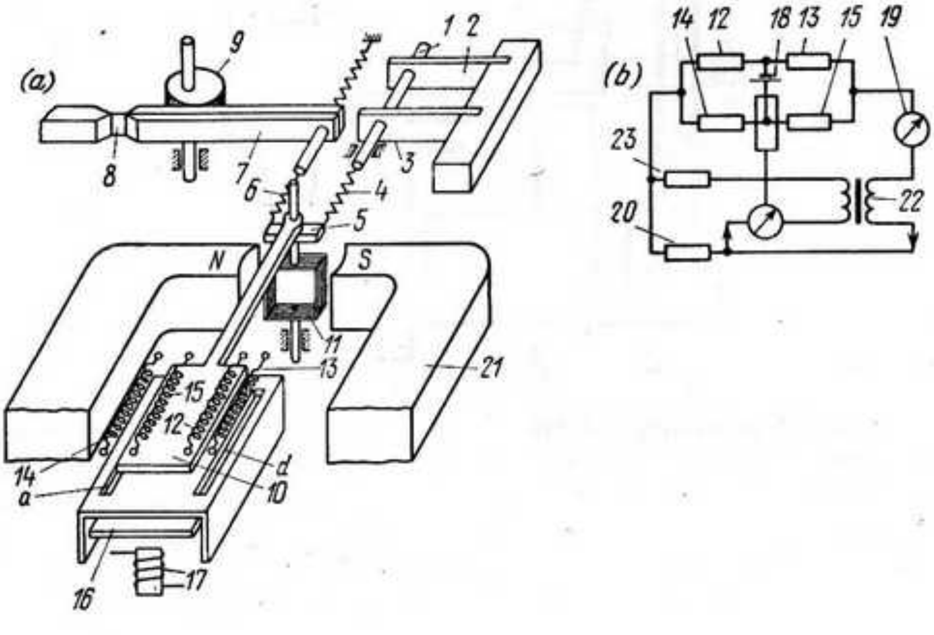
Air from the system is delivered through channel *a* of stationary piston *1* into cylinder *2*, moving this cylinder to the right. At this, indicating member *3*, connected to cylinder *2* by link *4*, is in the horizontal position. Upon a drop in pressure in the system below the permissible value, cylinder *2* is shifted to the left by spring *5*, turning indicating member *3* about fixed axis *A* to the vertical position (shown by dot-and-dash lines). At this, member *3* closes electric switch *6* of a circuit that lights the signal lamp.

4656	MERCURY-CONTACTOR PRESSURE-DROP WARNING DEVICE MECHANISM	CE M



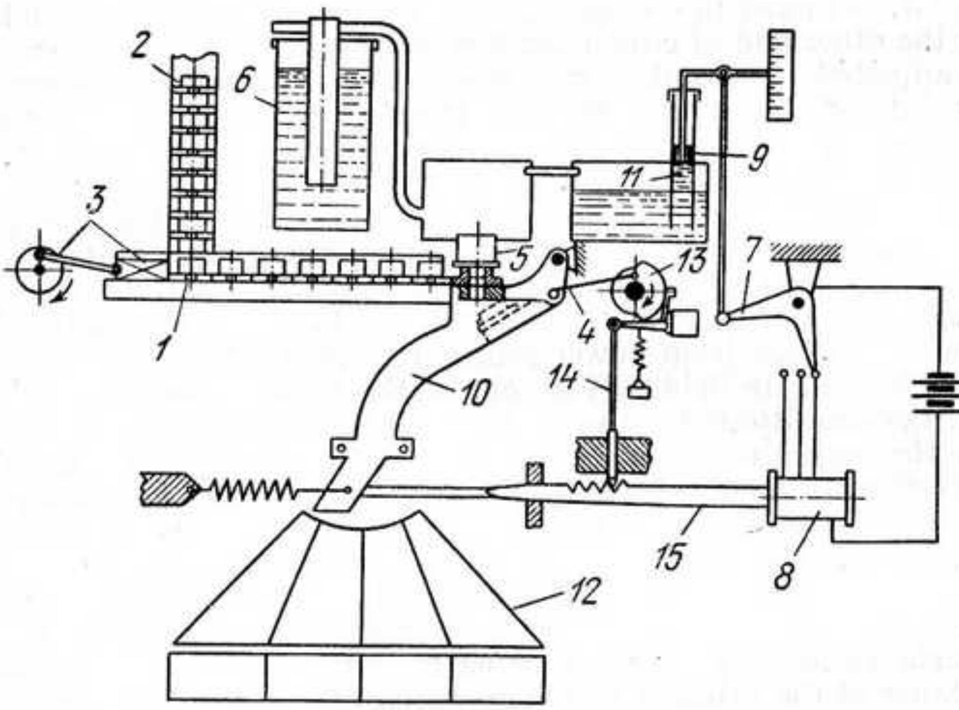
Upon normal pressure of the fluid in the system, connected to tube *1*, the mercury in vessel *2* and tube *3* closes contacts *a* and *d*. When the pressure in the system drops sufficiently for the level in tube *3* to be below contact *a*, the electric circuit is broken. This trips electromagnetic relay *4*, closing contacts *b* in the circuit of sonic signalling device *c*.

4657	BOLOMETRIC-TYPE MICROMETER MECHANISM	CE M



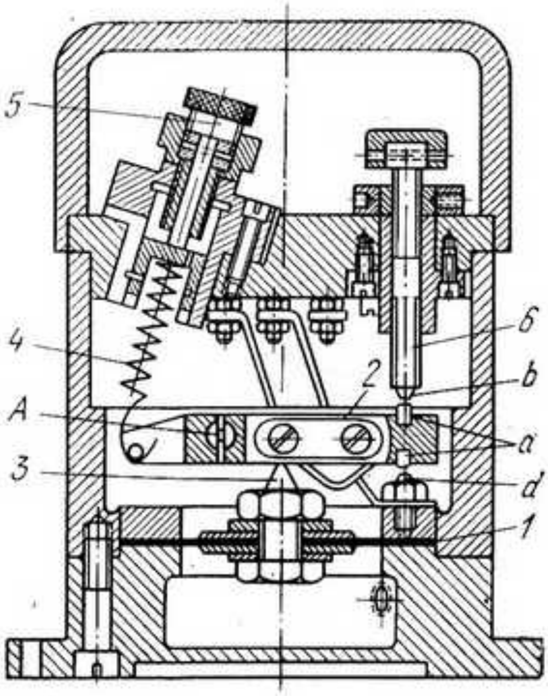
Measuring spindle *1* (Fig. *a*), suspended by flat springs (reeds) *2* and *3*, is linked to crosspiece *5* by measuring spring *4*. Attached to the other end of crosspiece *5* is setting spring *6* whose tension is adjusted by eccentric cam *9* and lever *7*. Lever *7* is mounted on flat spring (reed) *8*. Rigidly attached to crosspiece *5*, mounted on the shaft of coil *11* of a magnetoelectric instrument, is arm *10*. Resistors *12*, *13*, *14* and *15*, in the form of coils of wire, are arranged in pairs along the edges of arm *10* and above slots *a* and *d*. Pulsating streams of air, passing through slots *a* and *d*, are produced by membrane *16*, which is oscillated by a-c electromagnet *17*. Resistor coils *12*, *13*, *14* and *15* are heated by electric current from power source *18*, arranged in the diagonal of a Wheatstone bridge (Fig. *b*). In the central position of arm *10*, the conditions for the cooling of resistors *12*, *13*, *14* and *15* are the same and the bridge is balanced. When measuring spindle *1* is displaced, crosspiece *5* and arm *10* turn. At this, one pair of resistors is cooled more and the second pair is cooled less because the access of pulsating air to the first pair is opened and to the second pair is closed. Inequality of the resistance of resistors *12*, *13*, *14* and *15* and, consequently, of the electrical resistance pairwise of the four parts of the bridge, leads to disbalance of the bridge and the current in the measuring diagonal is measured by instrument *19*. The resulting drop in voltage over resistor *20* changes the current in the balancing magnetoelectric instrument that consists of moving coil *11* and permanent magnet *21*. At this, coil *11* develops a torque that counterbalances the torque developed by springs *4* and *6* upon a corresponding displacement of measuring spindle *1*. Feedback transformer *22* with resistors *20* and *23* are provided in the circuit of the balancing coil to induce a supplementary current during a change in the reading of instrument *19* and, thereby, to prevent swinging of coil *11*. The direction of this supplementary current is opposite to the balancing current and its magnitude is proportional to the rate of change in the current. In this way, oscillations of the system are damped.

4658	AUTOMATIC ELECTROPNEUMATIC GAUGING MECHANISM FOR CARBURETTOR JET INSPECTION	CE M



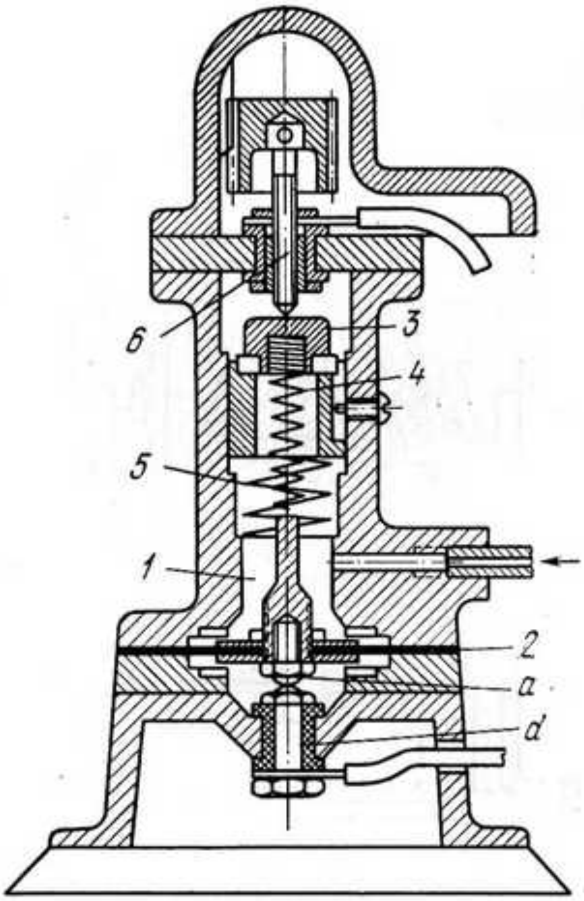
Jets *1* are delivered from loading device *2* to the measuring station by slider-crank mechanism *3* and are set into position by lever *4*. Compressed air is delivered to the nozzle of measuring head *5* through pneumatic gauging device *6*. The liquid level in manometer *11* varies with the air flow, which is determined by the size of the orifice in the jet being inspected. A change in the liquid level displaces piston *9*, turning lever *7* and closing a circuit including tappet windings of electromagnet *8*. Armature *15* of the electromagnet displaces sorting chute *10* so that the jet being inspected drops into one of the sorting boxes *12*. If the size of the orifice in the jet is not within the permissible tolerance limits, the system does not operate and the sorting chute remains in its initial position in which the jet drops into the reject box. By means of detent *14*, cam *13* locks armature *15* in the required position.

4659	PNEUMOELECTRIC HEAD MEASURING MECHANISM FOR WORKPIECE INSPECTION	CE M



Air, whose pressure depends upon the size of the workpiece being inspected, is admitted under membrane *1*. Mounted in the membrane is screw *3*, which bears against lever *2*. Lever *2* can turn about axis *A*. The pressure of the air on membrane *1* is counterbalanced by spring *4*, whose tension is adjusted by screw *5*. Lever *2* carries contacts *a*. Lower contact *a* makes contact with fixed contact *d*, and upper contact *a*, with adjustable contact *b*. The head is set up to the required size being inspected by screw *5*; the difference between the limits of size is varied by contact screw *6*.

4660	PNEUMOELECTRIC MEASURING HEAD MECHANISM FOR WORKPIECE INSPECTION	CE M



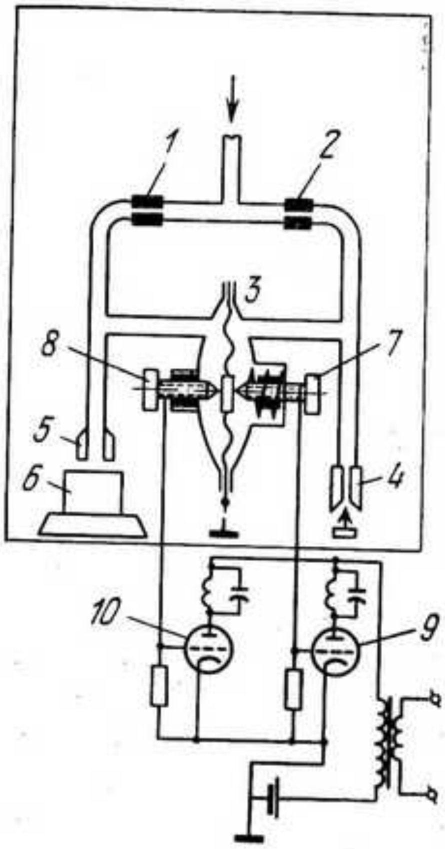
As the pressure in chamber *1*, connected to the measuring chamber, increases in accordance with the actual size of the workpiece being inspected, membrane *2* bends downward so that contact *a*, mounted in the membrane, makes contact with fixed contact *d*, insulated from the housing. These contacts close the circuit of a signalling device. Surplus pressure on membrane *2* is counterbalanced by spring *4*, whose upper end is secured to movable sleeve *3*. By means of powerful spring *5*, sleeve *3* is held against micrometric screw *6*, used to set up the instrument.

4661

PNEUMOELECTRIC MEASURING MECHANISM FOR WORKPIECE INSPECTION

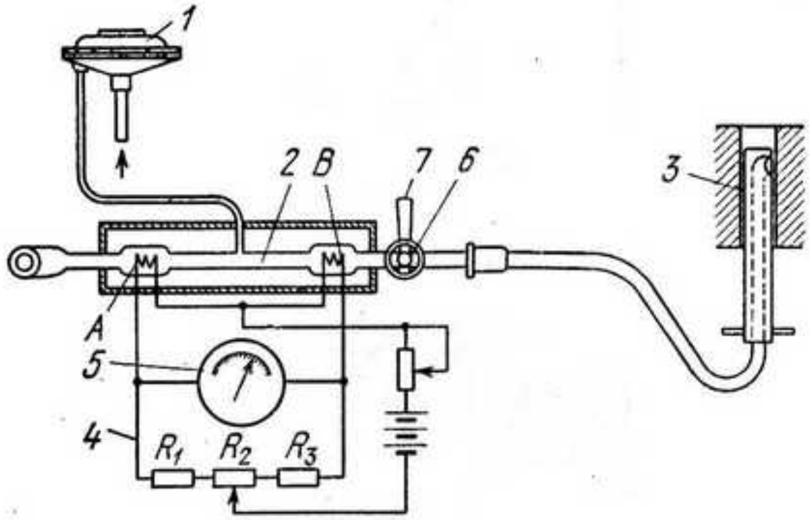
CE

M



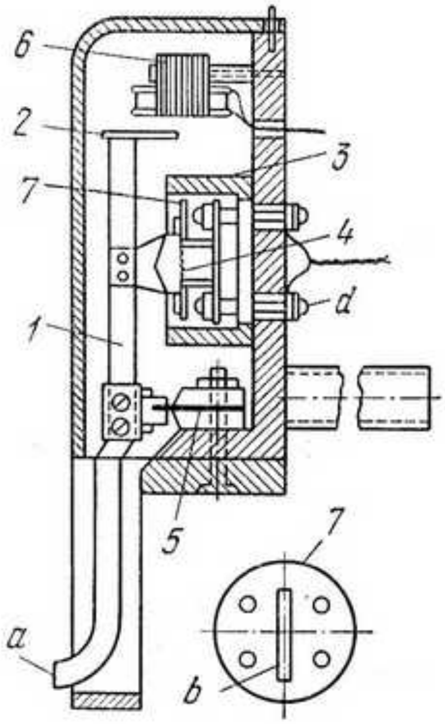
After passing through jets *1* and *2*, compressed air enters at both sides of membrane *3* and is released to the atmosphere through adjustable throttle valve *4*, on one side, and through the clearance between measuring head *5* and workpiece *6* being inspected, on the other side. Throttle valve *4* is adjusted so that in inspecting a workpiece of a size within the tolerance zone, both contacts, at *7* and *8* remain open. The contacts at *7* are closed when the workpiece is oversize, and the contacts at *8* when it is undersize. When either set of contacts is closed, the corresponding electron tube, *9* or *10*, is cut off, energizing an electromagnet (not shown) which rejects the off-size workpiece.

4662	PNEUMOELECTRIC MEASURING MECHANISM FOR WORKPIECE HOLE INSPECTION	CE M



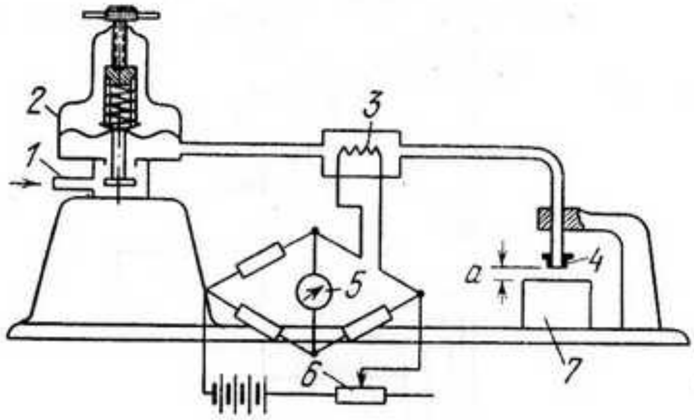
Compressed air is delivered through adjustable valve *1* into tube *2* in which the air stream is divided into two parts. The first part, flowing over wire filament *A*, is exhausted directly to the atmosphere. The second part, flowing over wire filament *B*, passes out through the clearance between the wall of the hole being inspected and measuring plug *3* of the instrument. The size of this clearance determines the air flow and the temperature of the filaments. This disturbs the equilibrium of bridge *4* and deflects the hand of galvanometer *5*, whose scale is graduated in units showing the deviation of the hole size from the specified value. The instrument is set to zero by adjusting rheostat R_2 when the filaments have the same temperature. The air pressure and the voltage of the electric circuit must be maintained constant. The instrument is checked by two-way valve *6* and check port *7*.

4663	AUTOMATIC PNEUMOELECTRIC SIZING MECHANISM	CE M



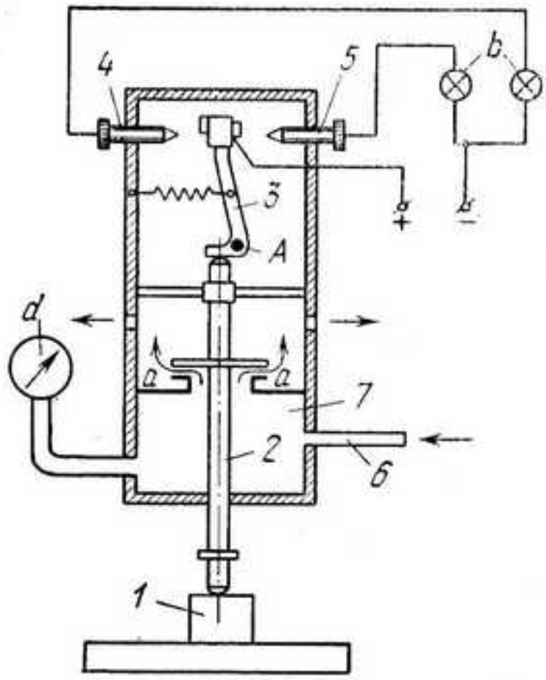
Vibrating lever *1* is mounted on flat spring (reed) *5* inside the housing and its tip *a* contacts the surface of the workpiece being inspected. Also mounted in the housing is electromagnet *6*, whose armature *2* imparts a vibrating motion to lever *1*. When tip *a* of lever *1* contacts the workpiece surface, the amplitude of vibration of the lever is restricted. Vibrating together with lever *1* is attached mica membrane *7*, having rectangular slot *b* and located inside cylinder *3*. Posts *d* are mounted with insulating washers at the bottom of cylinder *3*. Platinum or nickel wire *4*, serving as effective resistance, is soldered to the ends of posts *d*. Wire *4* is arranged in slot *b* of membrane *7* and does not contact the edges of the slot. Wire *4* is connected into one of the arms of a d-c Wheatstone bridge. The resistance of wire *4* varies with its temperature. An increase in the amplitude of vibration of membrane *7* increases the air velocity in slot *b*. This reduces the temperature and, consequently, the resistance of wire *4*, which is indicated by the deviation of the galvanometer hand. As tip *a* approaches the workpiece surface, the amplitude of vibration is reduced. The mechanism is set at the distance from the workpiece for which the amplitude of vibration of tip *a* puts the galvanometer hand at the centre of its scale when the workpiece reaches the required size in the machining operation. Any change in size of the workpiece changes the amplitude of vibration of tip *a* and is indicated by the deviation of the galvanometer hand.

4664	PNEUMOELECTRIC MEASURING MECHANISM FOR WORKPIECE INSPECTION	CE M



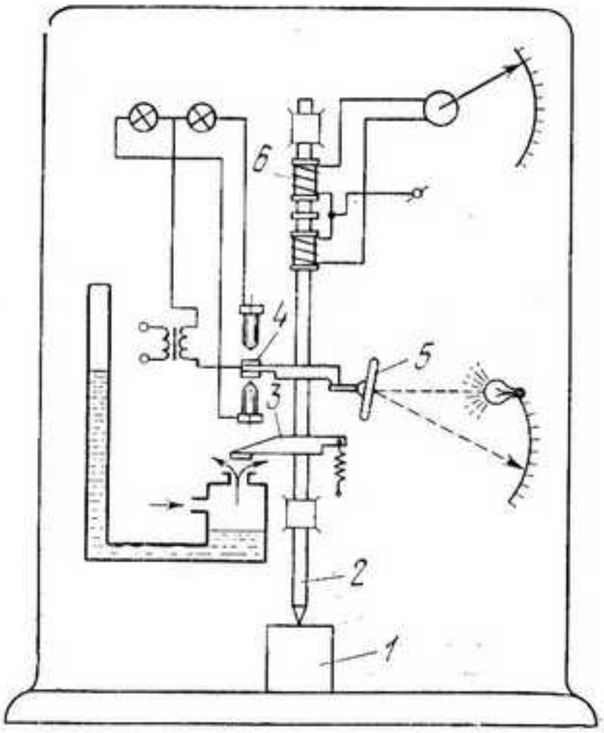
Compressed air is delivered through tube *1* into membrane-type pressure stabilizer *2*, from where it flows around heated wire *3* and passes to measuring head *4*. Heated wire *3* is one arm of a Wheatstone bridge, the other three arms being nonadjustable resistors selected so that the bridge is balanced and galvanometer *5* has a zero reading when wire *3* is at its normal working temperature. Fine adjustments to zero are made by means of rheostat *6*. The air flow and, consequently, the air velocity vary with clearance *a* between the face of measuring head *4* and workpiece *7* being inspected. This either heats or cools wire *3*, changing its resistance and disturbing the balance of the bridge. The deviation of the hand of galvanometer *5* indicates the deviation in size of the workpiece from the specified value.

4665	PNEUMOELECTRIC MEASURING MECHANISM FOR WORKPIECE INSPECTION	CE M



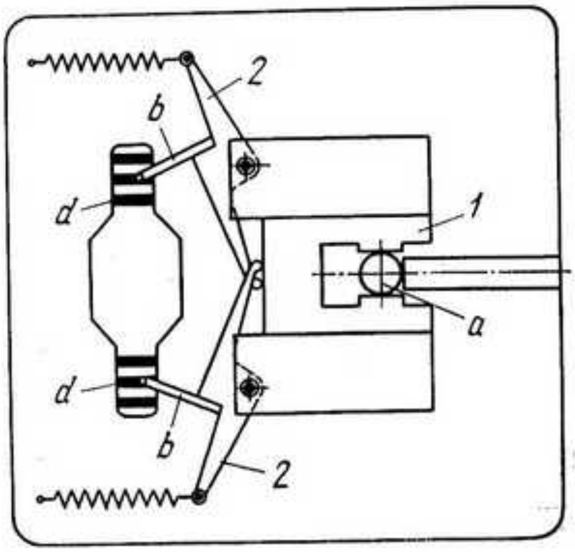
In inspecting the size of workpiece *1* measuring spindle *2* is raised or lowered, changing the annular clearance *a* and turning lever *3* about fixed axis *A*. Lever *3* closes the contacts at *4* or at *5*, depending on whether the workpiece is oversize or undersize. This lights the corresponding one of signal lamps *b*. Air entering chamber *7* through pipeline *6* passes through clearance *a*. The pressure in chamber *7* depends upon clearance *a* and is indicated by gauging device *d* (shown schematically). Thus, the instrument indicates both the actual size and whether the workpiece is larger or smaller than the permissible limits of size.

4666	MULTIPLE-SCALE PNEUMOELECTRIC MEASURING MECHANISM FOR WORKPIECE INSPECTION	CE M



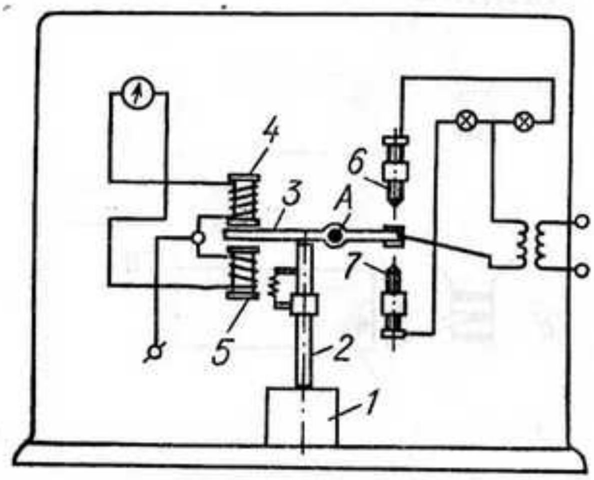
In inspecting workpiece *1* measuring spindle *2* is either raised or lowered, simultaneously actuating four devices: pneumatic device *3*, electric-contact device *4*, optical device *5* and induction device *6*. This indicates the actual size simultaneously on three scales, and signal lamps indicate whether an off-size workpiece is undersize or oversize.

4667 **ELECTRIC-CONTACT MEASURING MECHANISM FOR WORKPIECE DIAMETER INSPECTION** CE M



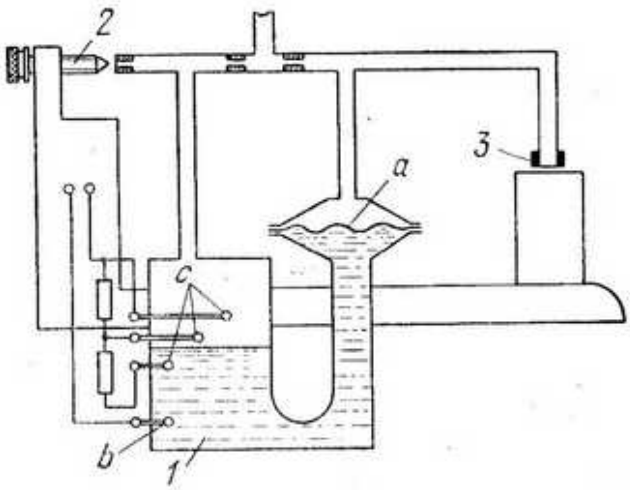
The mechanism is used in checking the external diameters of workpieces. Workpiece *a* is pushed into snap gauging member *1*, which has stepped anvils for several sizes. As it moves to the right, member *1* turns two-arm levers *2*, carrying moving contacts *b*. Member *1* moves to the right until workpiece *a* reaches the gauge step of the corresponding size. This moves contacts *b* to the corresponding plates *d* to switch on the signal device for the given actual size of workpiece *a*.

4668	INDUCTANCE ELECTRIC-CONTACT PICKUP MECHANISM FOR WORKPIECE INSPECTION	CE M



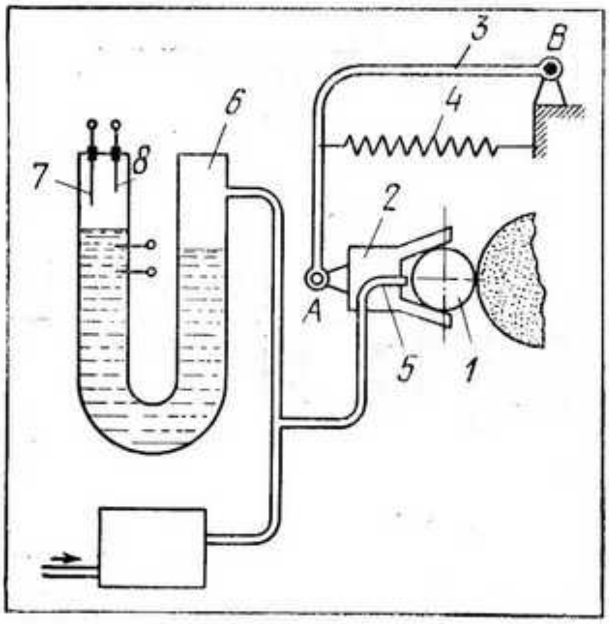
In inspecting the size of workpiece *1* measuring spindle *2* is raised or lowered, turning lever *3* about fixed axis *A*. This changes the inductance of coils *4* and *5* for which lever *3* is the armature. When workpiece *1* is undersize or oversize, lever *3* also closes the contacts at *6* or *7* to light the corresponding signal lamp. The changed inductance of coils *4* and *5* is used to indicate the actual size.

4669	LIQUID-TYPE PNEUMOELECTRIC PICKUP MECHANISM FOR WORKPIECE INSPECTION	GE M



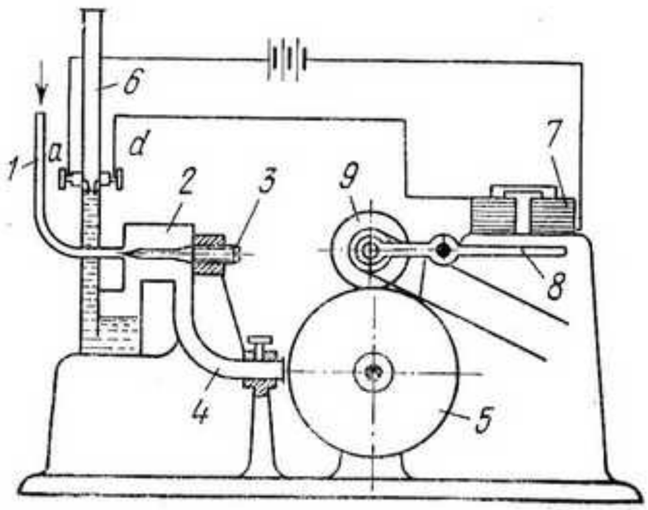
Compressed air is admitted to both branches of liquid-column manometer *1*, which responds to a pressure difference. One branch of the manometer is connected to pressure stabilizer *2* and the other branch, to measuring head *3*. The magnitude of the back pressure in stabilizer *2* is set equal to the pressure in the measuring system of the instrument when inspecting a workpiece of an actual size corresponding to the middle of the tolerance zone. The back pressure is regulated with a cone valve. Membrane *a* keeps the liquid from being thrown upward into the pickup. At definite limits of size, the pressure developed forces the liquid into the left-hand branch of the manometer, closing contact *b* and corresponding contact *c*.

4670	MERCURY-CONTACTOR PNEUMOELECTRIC AUTOMATIC SIZING MECHANISM	CE M



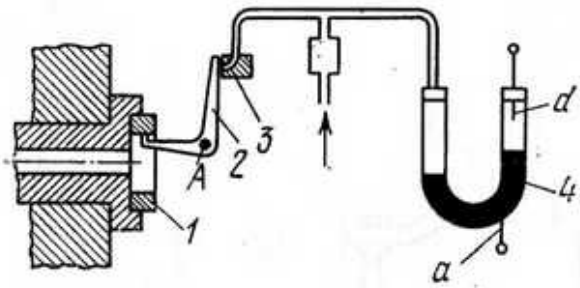
Measuring head 2 is connected by turning pair A to lever 3, which turns about fixed axis B. As the diameter of workpiece 1 is being reduced in grinding, the clearance between air outlet nozzle 5 and the workpiece surface decreases. Measuring head 2 is held in contact with workpiece 1 by spring 4. As the clearance decreases, the pressure of the air in mercury contactor 6 increases, raising the mercury level in the left branch of the contactor. At the end of the rough grinding operation, the mercury reaches contact 7, closing a circuit for switching over to the finishing feed. When workpiece 1 is ground to the specified diameter, the mercury reaches contact 8, closing a circuit that switches off the grinder.

4671	MERCURY-CONTACTOR PNEUMOELECTRIC AUTOMATIC SIZING MECHANISM	CE M



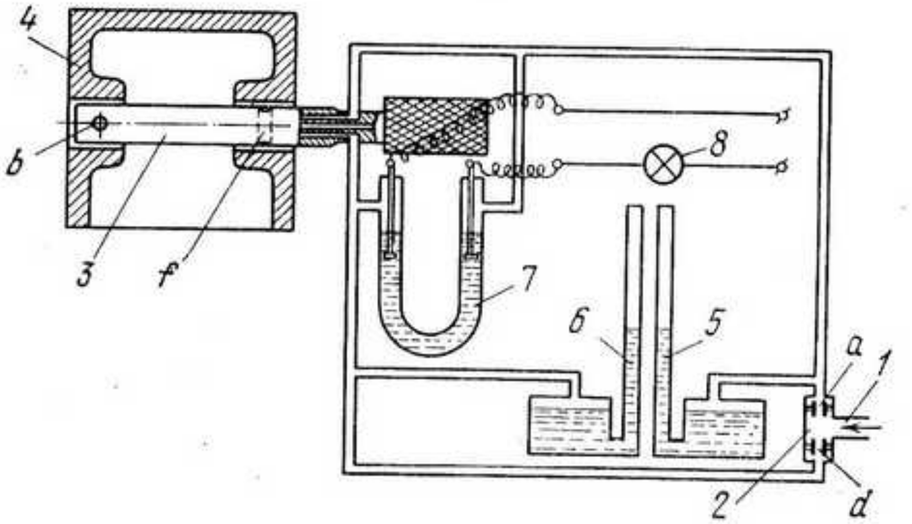
Compressed air is delivered through pipeline *1* into chamber *2*. The air flow is regulated by needle throttle valve *3*. From chamber *2* the air passes through nozzle *4*, set up with a small clearance between the nozzle face and the surface being ground on workpiece *5*. Chamber *2* is connected to mercury contactor *6*. As workpiece *5* is being ground, the clearance between nozzle *4* and workpiece *5* increases, air flows out of the nozzle at a higher velocity, and, as a result, the pressure drops in nozzle *4* and chamber *2*, lowering the mercury level in contactor *6*. When workpiece *5* is ground to the specified diameter, the mercury level drops below contacts *a* and *d*, breaking the electric circuit of electromagnet *7* so that armature *8* is released. Armature *8* is turned clockwise by a spring (not shown), raising grinding wheel *9* and stopping the grinding operation.

4672	MERCURY-CONTACTOR PNEUMOELECTRIC AUTOMATIC SIZING MECHANISM	CE M



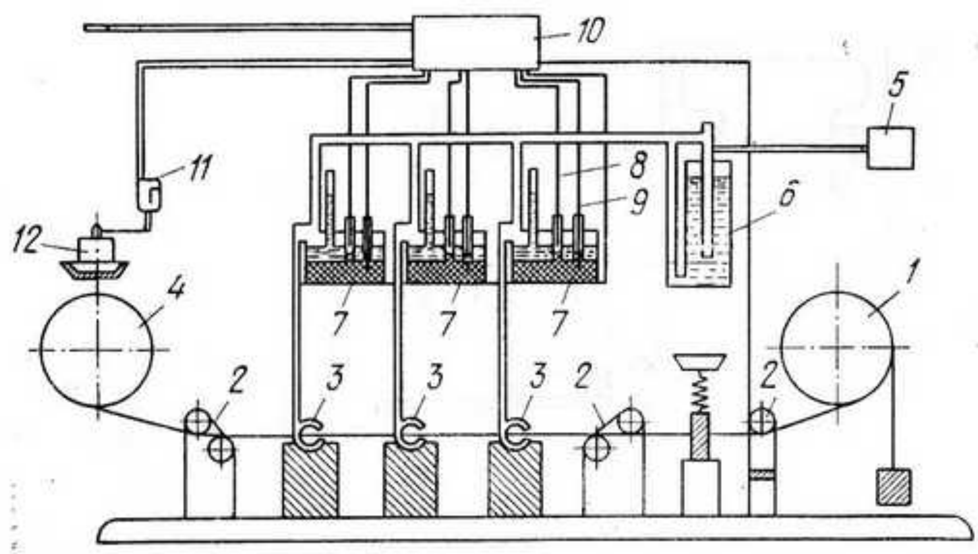
As the inside diameter of workpiece 1, being ground in an internal grinder, increases, bell-crank lever 2 turns clockwise about fixed axis A. One end of lever 2 carries a diamond tip that contacts the surface being ground. As lever 2 turns, its other end approaches nozzle 3, to which compressed air is delivered. As the clearance between lever 2 and nozzle 3 is reduced, the air pressure increases. This raises the mercury level in the right branch of U-shaped tube 4. When the hole being ground reaches the specified diameter, the mercury in tube 4 closes contacts a and d, tripping a relay which stops the grinder.

4673	MERCURY-CONTACTOR PNEUMOELECTRIC MEASURING MECHANISM FOR HOLE OUT-OF-ROUNDNESS AND TAPER INSPECTION	CE M



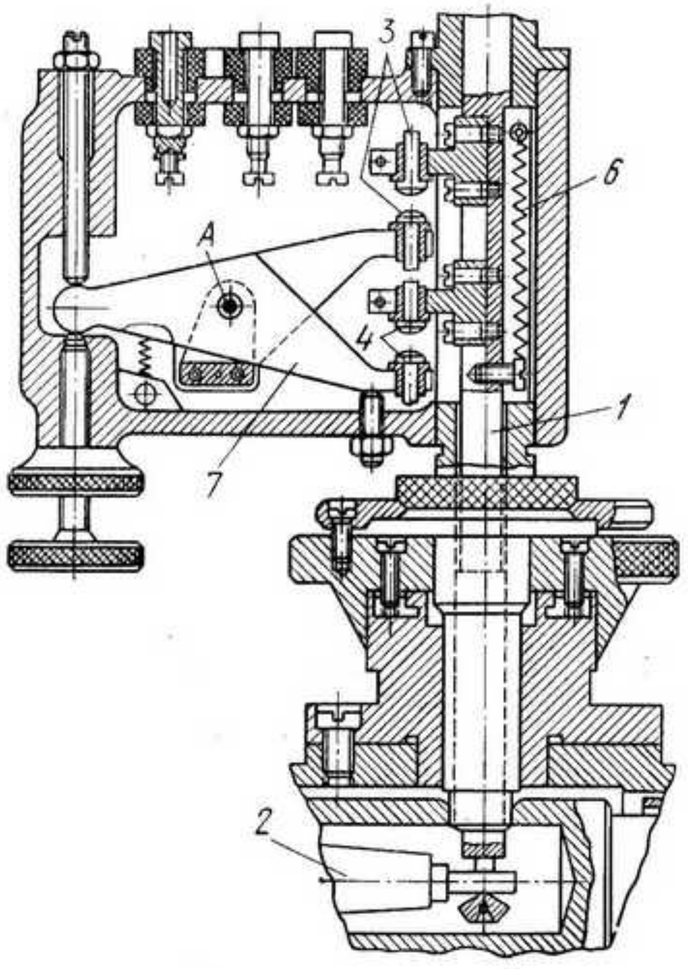
Compressed air is delivered by pipeline *1* into chamber *2* from where it passes through jets *a* and *d* to measuring head *3*. Head *3* has two pairs of measuring nozzles, *b* and *f*, by means of which the diameters are checked simultaneously in the bores of both bosses of piston *4*. The axes of nozzles *b* and *f* are perpendicular to each other. Manometers *5* and *6* indicate the results of measurement on scales graduated in units of deviation from the specified dimension. Out-of-roundness and taper are checked by airtight U-shaped mercury contactor *7*, which lights lamp *8* when the out-of-roundness and taper are within the tolerances. Otherwise, the mercury in the branches is at sufficiently different levels to open the contact in one branch, breaking the circuit and putting out the lamp.

4674	MERCURY-CONTACTOR PNEUMOELECTRIC MEASURING MECHANISM FOR BAND THICKNESS INSPECTION	CE M I

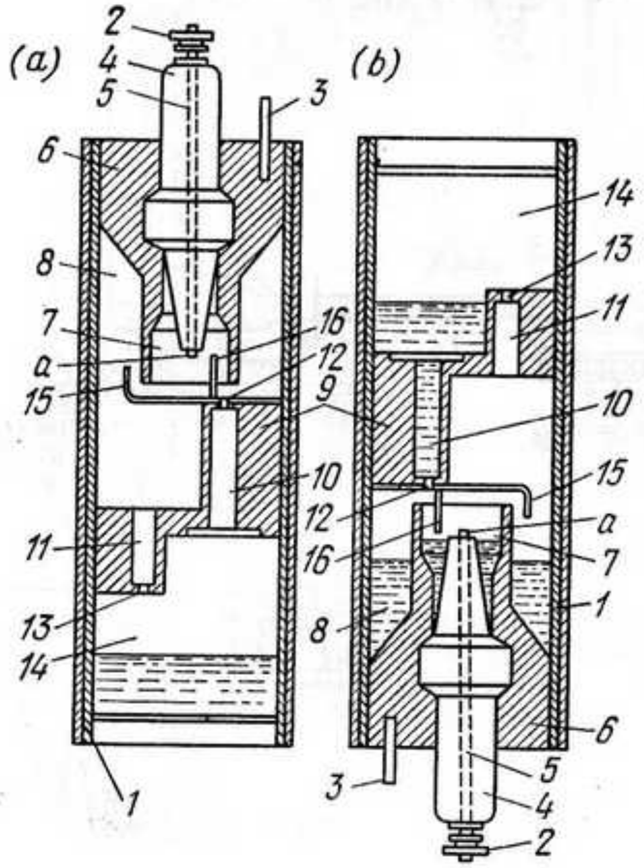


The band being inspected is uncoiled from drum *1*. It passes through guide rollers *2*, measuring heads *3* and is coiled on driving drum *4*. Compressor *5* delivers compressed air to the nozzles of measuring heads *3* through manometric measuring instrument *6*. Band thickness is checked at three places simultaneously (at the middle and both edges). Variations in the clearances between the faces of the measuring head nozzles and the band surface, due to variations in band thickness, change the air pressure and mercury level in mercury contactors *7*. When the band thickness exceeds the permissible value, the mercury level rises and closes the contact at *8*; when it is thinner than the permissible value, the mercury level drops and opens the contact at *9*. In either case, relay *10* is tripped. This energizes the winding of electromagnet *11*, which disengages clutch *12* in the drive of drum *4*.

4675	ELECTRIC-CONTACT AUTOMATIC SIZING MECHANISM	CE M

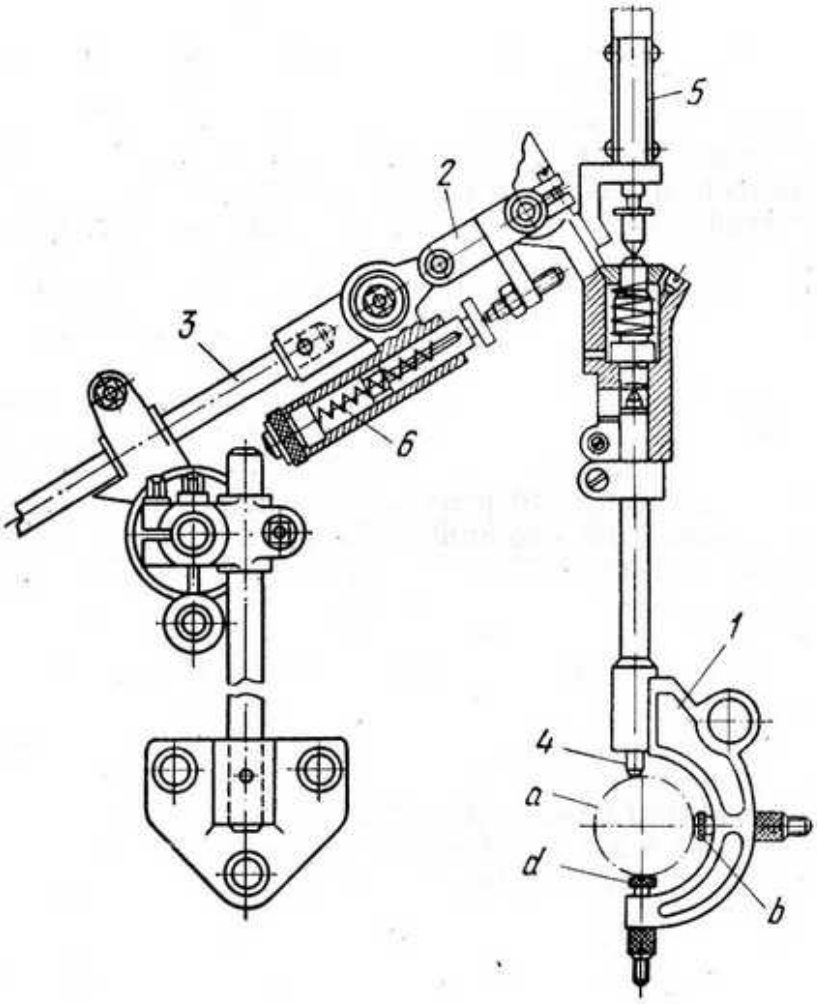


Spindle *1*, linked through lever *2* to a measuring tip that contacts the surface being machined, carries two contacts, *3* and *4*. The measuring tip is held against the workpiece surface by spring *6*. Lever *7*, turning about fixed axis *A*, carries pairing contacts, *3* and *4*, which can be adjusted by a system of screws. In the machining process spindle *1* moves downward, consecutively closing contacts *3* and *4* which control the speeds and feeds of the machine tool.


(a)
(b)
2
4
5
3
6
8
7
a
15
16
12
9
10
11
13
14
1

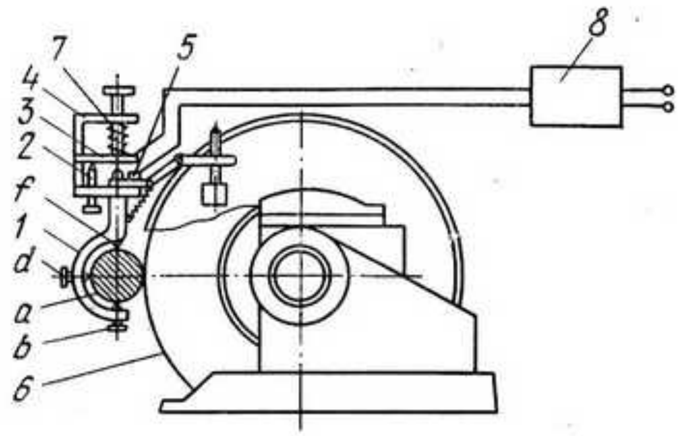
Cylinder *1* of the contactor is enclosed in a sleeve having a trunnion about which the cylinder can rotate. When the cylinder is in the position shown in Fig. *a*, contacts *2* and *3* are open. Contact *2* is connected to metal conducting rod *5*, fitting into insulating porcelain bush *4* in such a way that only short piece *a* of the rod sticks out of the bush inside the cylinder. Contact *3* is screwed into thick metal bottom *6* of the cylinder. Bottom *6* is of special shape and forms two recesses, one surrounding porcelain bush *4* in the form of deep cup *7*, and the other forming concentric annular recess *8* between bottom *6* and the wall of cylinder *1*. Recess *8* is the interlocking chamber. Partition *9* inside the cylinder has two connecting passages, *10* and *11*, with small-diameter orifices *12* and *13* at their ends. The purpose of the orifices is to provide a sufficient time delay as the mercury drains from one end of the cylinder to the other. When the cylinder is turned 180° (Fig. *b*), the mercury begins to drain slowly from recess *14* into cuplike recess *7* through orifice *12*. When sufficient mercury has drained into recess *7* for the mercury level to reach tip *a* of rod *5*, contacts *2* and *3* are closed. The time delay depends on the size of orifice *12* and of recess 7. When cylinder *1* is turned back to the position shown in Fig. *a*, contacts *2* and *3* are opened and the mercury begins to drain back into recess *14* through orifice *13*. If it is necessary to close contacts *2* and *3* again before all the mercury has drained back to recess *14*, this can be done because, when cylinder *1* is turned to the position in Fig. *b*, the mercury that did not have sufficient time to drain back to recess *14* (in the position in Fig. *a*) flows into interlocking chamber *8* and recess *7* begins to fill again with mercury from recess *14*. Two safety partitions, *15* and *16*, are provided to prevent the stream of mercury from making accidental contact in flowing into interlocking chamber *8*.

4677	ELECTRIC-CONTACT AUTOMATIC SIZING MECHANISM FOR GRINDING	CE M



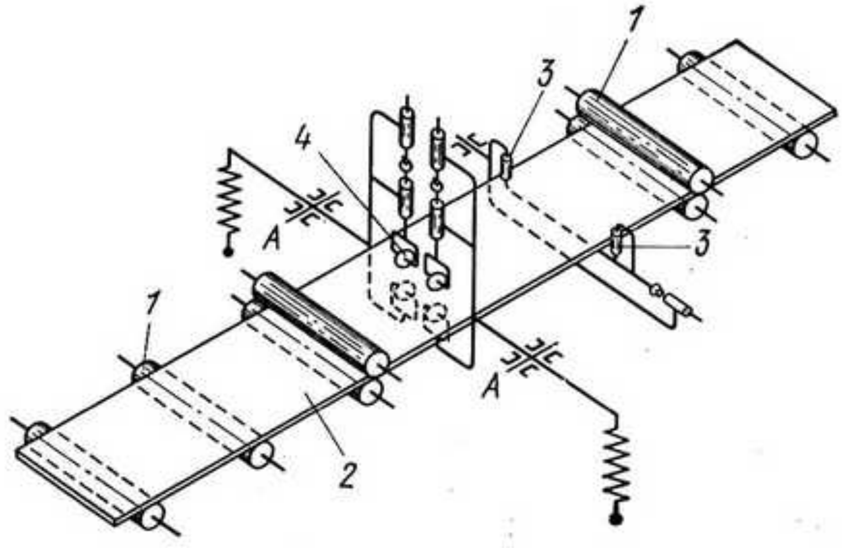
The mechanism serves to control the process of external cylindrical grinding. Sizing caliper *1*, put over workpiece *a*, is suspended by intermediate link *2* from fixed bracket *3*, which can be clamped in any required position on a support. Caliper *1* has two adjustable stationary reference contacts *b* and *d*. As the diameter of workpiece *a* is gradually reduced by grinding, measuring spindle (sensitive contact) *4* displaces rod *5* of a two-contact electric switching device that switches the grinder over from rough to finishing grinding upon reaching the corresponding diameter, and switches off the grinder when the workpiece diameter reaches the upper tolerance limit. Spring *6* raises caliper *1* after it is removed from workpiece *a*.

4678 | **PIEZOELECTRIC AUTOMATIC SIZING MECHANISM FOR GRINDING** | CE M



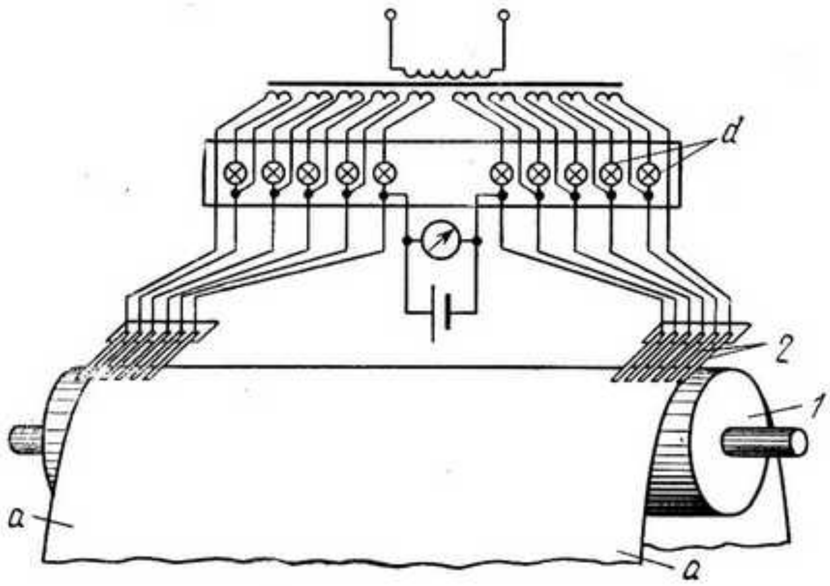
Caliper *1*, mounted on the guard of grinding wheel *6*, is advanced to workpiece *a* so that its three contacts, *d*, *b* and *f*, touch the surface being ground. Of the contacts, *d* and *b* are stationary reference contact points, and *f* is the sensitive (movable) contact. As the diameter of workpiece *a* is gradually reduced in grinding, contact *f* moves downward, displacing rod *2*, on the end of which metal plate *3* is fastened on an insulating spacer. Plate *3* can be moved along the side member of yoke *4* by spring *7*. Piezoelectric crystal *5* is mounted on the lower member of yoke *4*. When plate *3* compresses crystal *5*, an electric charge is developed at the face of the crystal. After being amplified in amplifier *8*, the charge is transmitted to a device that controls the feed of grinding wheel *6*.

4679	ELECTROMAGNETIC MEASURING MECHANISM FOR BAND THICKNESS AND WIDTH INSPECTION	CE M



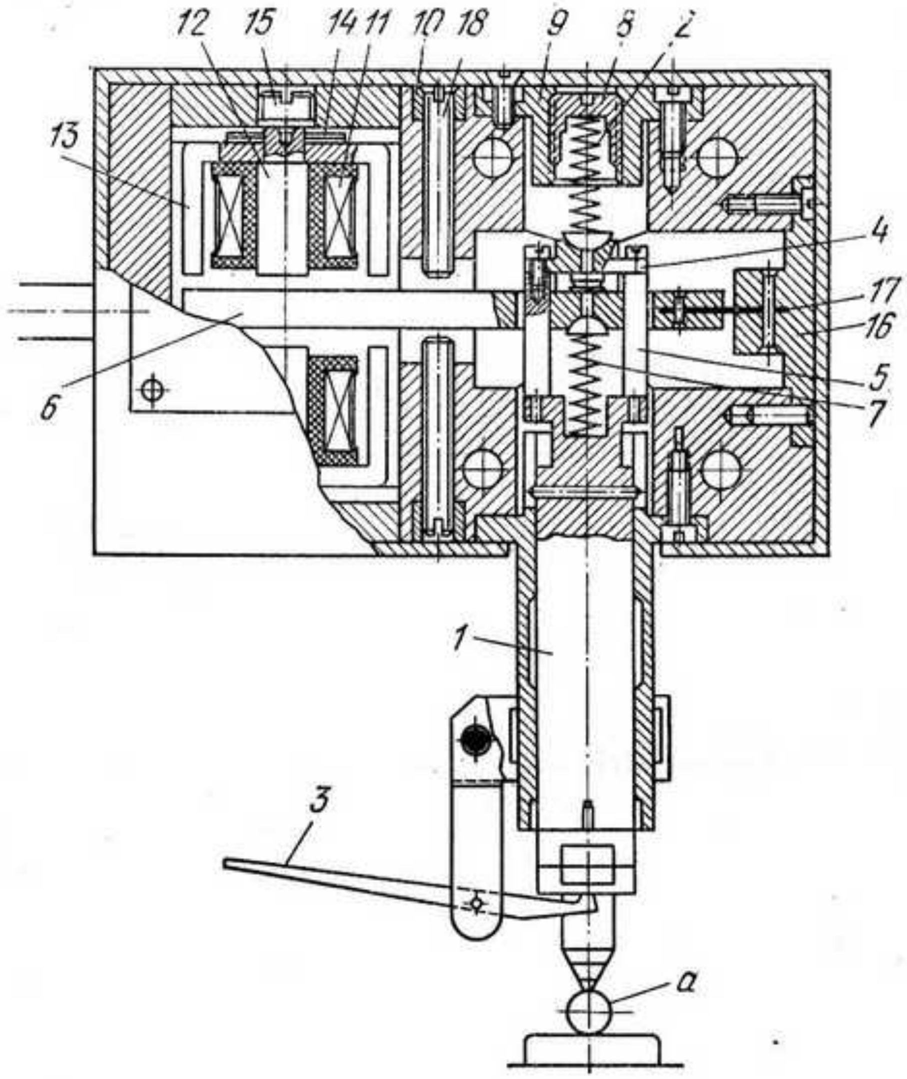
The mechanism is intended for continuously checking the thickness and width of a moving band. Live rollers *1* advance band *2*. The band width is checked by electric-contact head *3*; the band thickness is checked at two points by measuring electric-contact heads *4*. To eliminate errors due to bending of the band, heads *4* can tilt about fixed axes *A*.

4680	MOROZOV ELECTRIC-CONTACT MEASURING MECHANISM FOR CHECKING THE WIDTH OF PAPER STRIP	CE M



The width of paper strip *a* is continuously checked in the paper-making process by electric signal contacts *2*, spaced at a certain distance from one another at the surface of metal roll *1* over which paper strip *a* runs. The indicating devices are signal lamps *d*, switched on by contacts *2*. A series of lamps *d* are switched on depending upon the width of paper strip *a* which insulates contacts *2* from roll *1*.

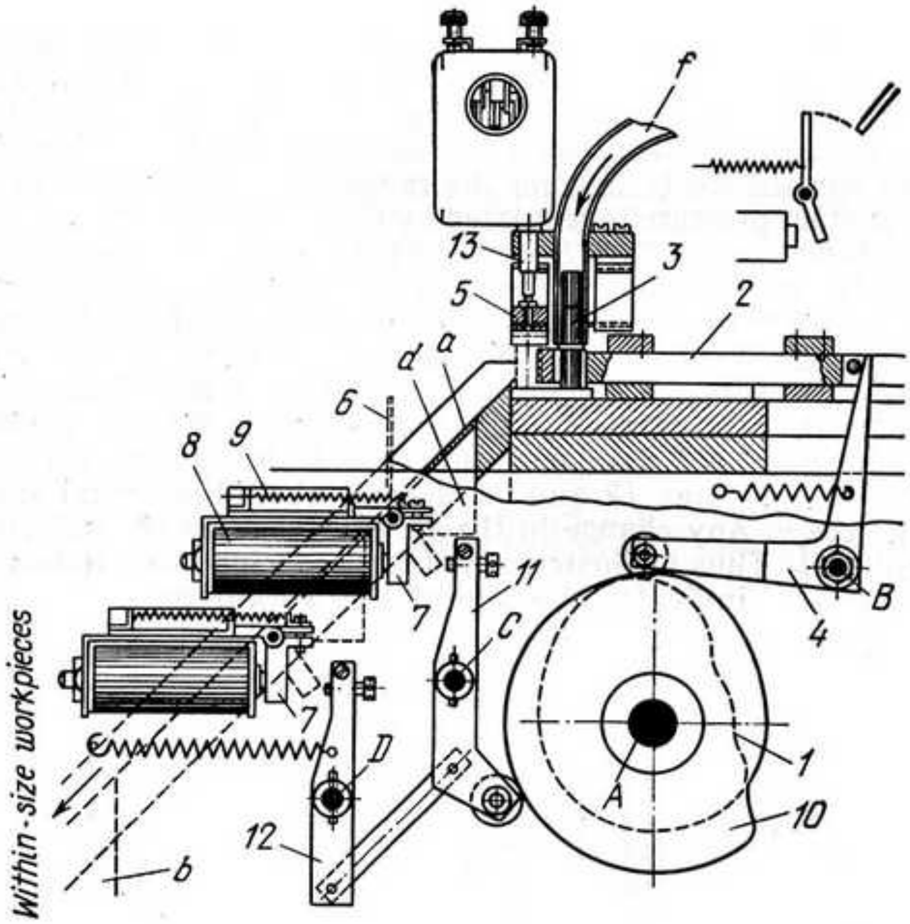
4681	INDUCTANCE PICKUP MECHANISM FOR WORKPIECE INSPECTION	CE M



4681	INDUCTANCE PICKUP MECHANISM FOR WORKPIECE INSPECTION	CE M

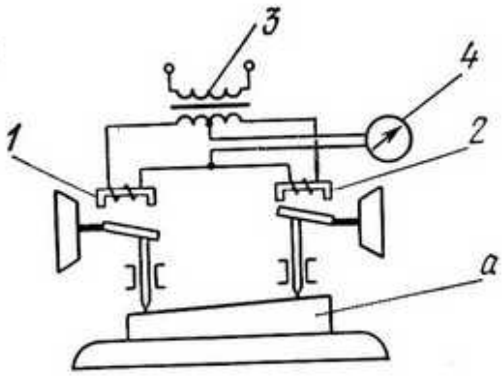
Measuring spindle *1* is held in contact with workpiece *a* being inspected by spring *2*. Flange *4*, secured to uprights *5*, serves as a thrust member for armature *6*, which is held against flange *4* by spring *7*. Such a design of measuring spindle *1* allows it to move upward freely beyond the range of normal measurement. The contact pressure is regulated by threaded member *8*, screwed into flange *9*. Coils *11* are tightly fitted on cores *12*. The magnetic circuits consist of cores *12* and *13*, attached to the housing by flat springs *14*. The air gaps are regulated by screws *15*. The displacement of armature *6*, attached by flat spring (reed) *17* to flange *16*, is limited by screws *18* with locknuts *10*. Retracting lever *3* serves to raise measuring spindle *1* manually. The air gaps between armature *6* and the magnetic circuits consisting of cores *12* and *13* depend upon the actual size of workpiece *a*. Any change in the air gaps changes the inductance of coils *11*. Thus an instrument for measuring their inductance indicates the size of the workpiece.

4682 | **ELECTROMAGNETIC MEASURING MECHANISM FOR WORKPIECE HEIGHT INSPECTION** | CE M



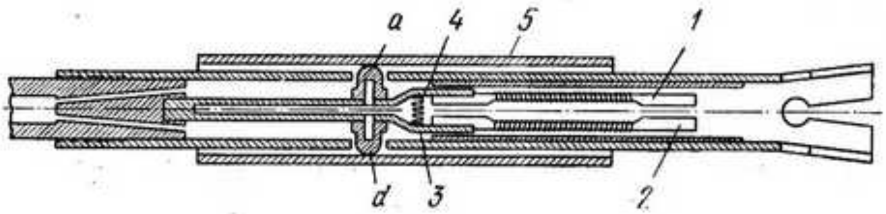
When cam *1* rotates about fixed axis *A*, lever *4* turns about fixed axis *B* and reciprocates pusher *2*. Workpiece *3*, fed through feeding tube *f*, is advanced by pusher *2* under feeler *5* on which measuring spindle *13* rests. After being measured, workpiece *3* is ejected by the same pusher to inclined chute *a*, on which deflectors *6* are arranged. Deflectors *6* are linked to armatures *7* of electromagnets *8*. When there are no rejects, the windings of the electromagnets are energized. Armatures *7* are attracted by the electromagnets and deflectors *6* are in the closed position, so that workpiece *3* slides past them into the finished-parts box *b*. If workpiece *3* is undersize, the winding of first electromagnet *8* is de-energized, spring *9* turns armature *7* and deflector *6* pushes the undersize workpiece into reject box *d*. If workpiece *3* is oversize, the winding of second electromagnet *8* is de-energized and corresponding deflector *6* pushes the oversize workpiece into the rework box. When each workpiece has been sorted, cam *10* turns levers *11* and *12* about fixed axes *C* and *D* to stretch their springs *9* and to advance the armature of the de-energized electromagnet to the core. When the current is switched on, the deflector of each armature is returned to the initial position.

4683	**INDUCTANCE PICKUP MECHANISM FOR WORKPIECE TAPER INSPECTION**	CE M



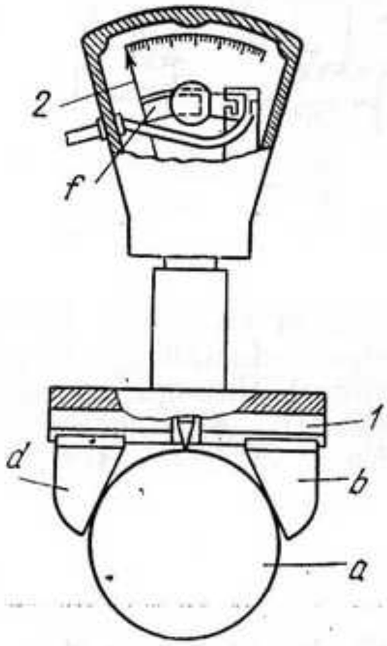
The difference in height at the two ends of workpiece *a* is measured by two independent inductance pickups *1* and *2*, connected into a differential circuit through transformer *3*. Measuring instrument *4* indicates the difference in inductance of the pickups and, consequently, the taper of workpiece *a*.

4684	**SOLENOID-TYPE MEASURING MECHANISM FOR PIPE INSIDE DIAMETER INSPECTION**	CE M



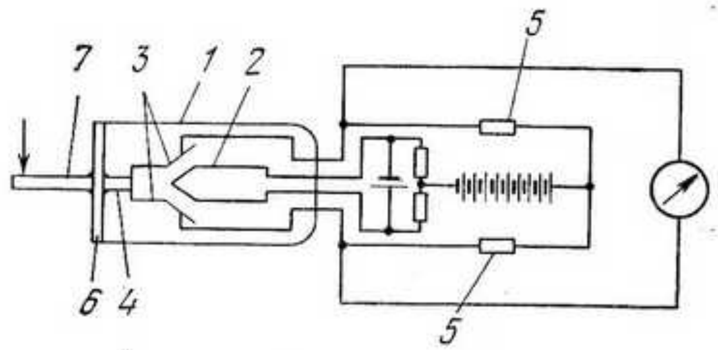
Two solenoids, *1* and *2*, are mounted on the prongs of fork *3*. Contact points *a* and *d*, mounted rigidly on the prongs of fork *3* are held against the inside surface of pipe *5* being inspected by spring *4*, and slide along this surface. The distance between solenoids *1* and *2* varies, depending upon the actual inside diameter of pipe *5*. If a constant voltage is applied over the coil of one solenoid, the current induced in the coil of the other solenoid depends upon the distance between the coils, i.e. upon the inside diameter of pipe *5*.

4685 **AUTOMATIC PHOTOELECTRIC SIZING MECHANISM FOR GRINDING** CE M



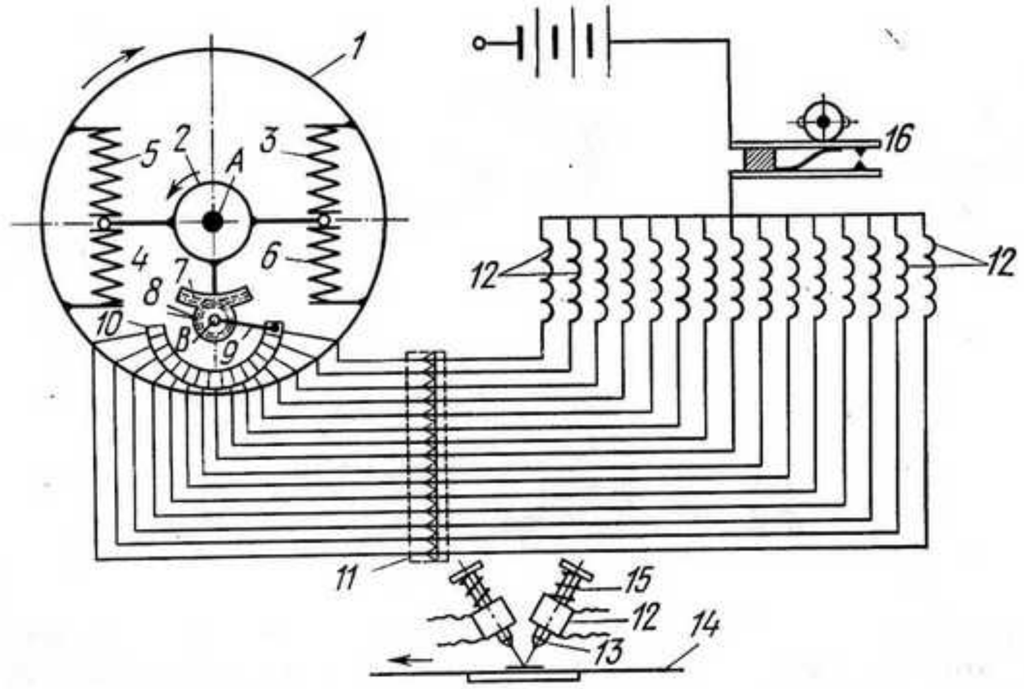
Measuring head *1* rests on the surface of workpiece *a* being ground, contacting the surface by two adjustable stationary jaws *d* and *b*. Measuring is accomplished by a precision indicator. Arm *f*, mounted rigidly on hand *2* of the indicator, closes a slit in the partition separating the light source chamber from the photoelectric tube chamber. When the workpiece being ground reaches the specified size, arm *f* of hand *2* opens the slit, a beam of light reaches the photoelectric tube and the amplifier circuit (not shown) changes the grinding feed (or stops the grinder) by means of an intermediate relay.

4686 | ELECTRONIC MICROMETER MECHANISM | CE M



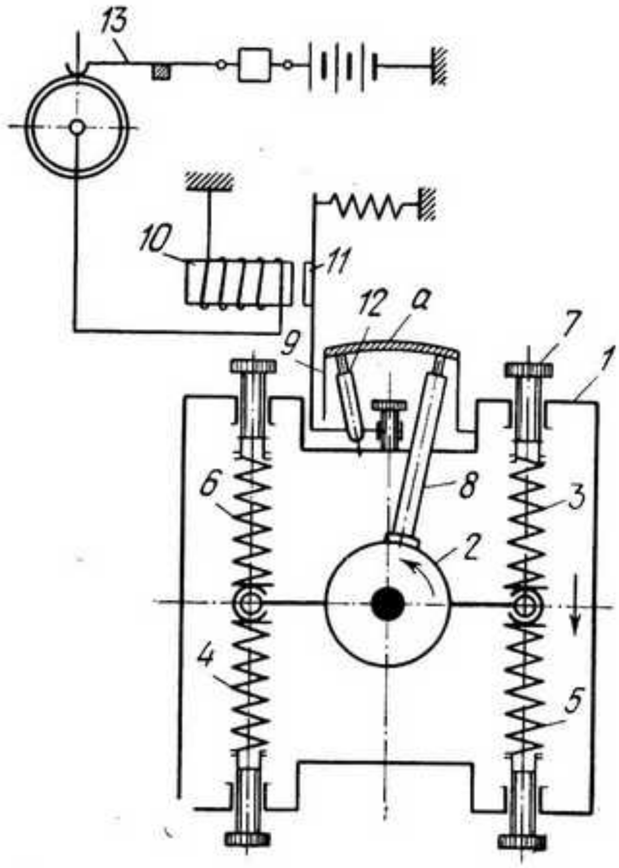
The electronic micrometer consists of evacuated bulb *1*, containing filament *2*, which emits electrons, and two anodes *3*, mounted on holder *4*. Holder *4* is secured in elastic bottom *6*. During inspection of workpieces, the end of rod *7* is displaced downward by various amounts. This deforms bottom *6* and anode holder *4* is displaced so that one anode *3* approaches filament (cathode) *2* and the other anode is withdrawn from the filament. This redistributes the electron flow inside the bulb, leading to a change in the state of a Wheatstone bridge of which two arms with variable resistance are the electron flow between each anode and the common cathode, and the other two arms are resistors *5* with constant resistance.

4687	ELECTRIC-CONTACT TORQUE DYNAMOGRAPH MECHANISM	CE M



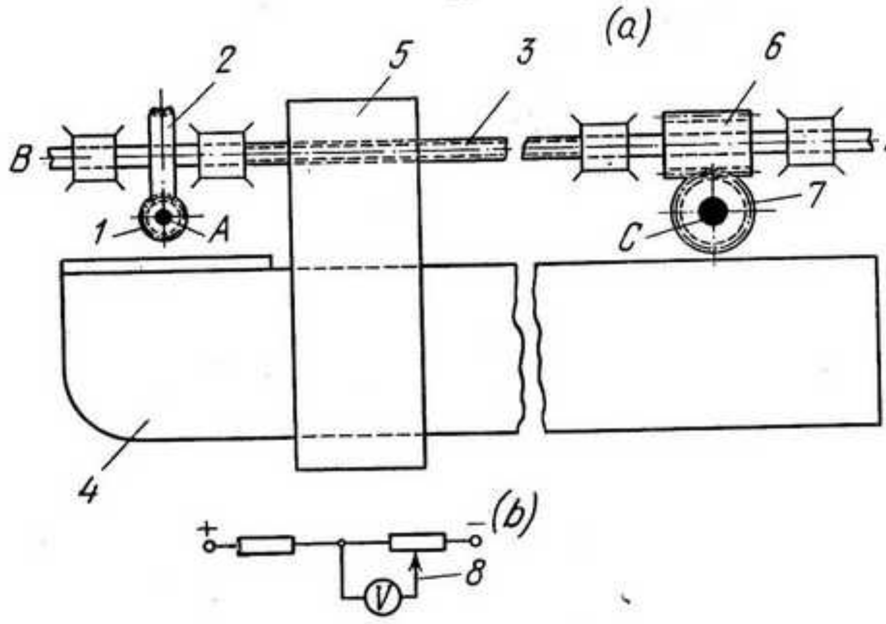
Rotation is transmitted from the driving shaft to the driven shaft through spring coupling *1*, whose angle of relative twist is proportional to the torque being measured. Torque is transmitted by springs *3*, *4*, *5* and *6*. Segment gear *7* is rigidly mounted on sleeve *2*, which rotates about fixed axis *A*, and meshes with pinion *8*, which rotates about axis *B*. Holder *9*, rigidly mounted on pinion *8*, carries a slider that slides along segments *10*, which are insulated from one another. Each segment *10* is connected through current collector disk *11* to the recording instrument. This instrument consists of solenoid coils *12*, whose styluses *13* are advanced by the current pulses so that their pointed ends strike plotting paper *14* through an inked ribbon, registering the magnitude of the torque being transmitted. Styluses *13* are returned to their initial position by springs *15*. The distances between the points along the length of the diagram are determined by the time intervals between the current pulses produced by interrupter *16*.

4688	TORQUE DYNAMOGRAPH MECHANISM WITH AN ELECTRIC TIMER	CE M



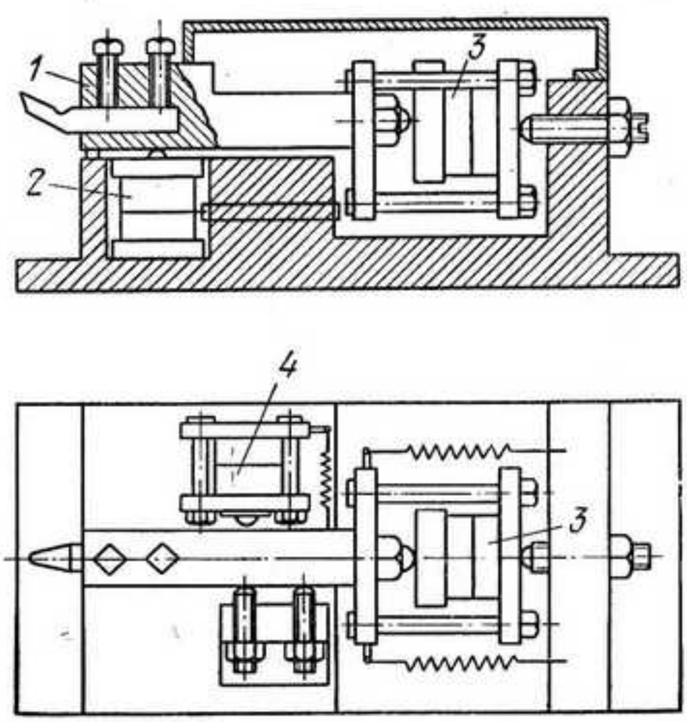
Torque is transmitted from housing *1*, mounted rigidly on the driving shaft, to sleeve *2*, mounted rigidly on the driven shaft, through springs *3*, *4*, *5* and *6*, which are prestressed by screws *7*. The springs are arranged in a single plane between housing *1* and sleeve *2*. Pen *8*, rigidly mounted on sleeve *2*, is displaced upon variations in torque with respect to the housing of recorder *9*. The recorder is mounted on housing *1* and the strip of plotting paper *a* runs through the recorder in the direction perpendicular to the plane of the drawing. Also plotted on the paper strip, in addition to the torque curve, are time marks. This is done by means of an electric timer, consisting of electromagnet *10*, armature *11* and the holder of recording pen *12*. Connected into the circuit of electromagnet *10* is contact-type timer *13*, which transmits current pulses at equal time intervals to electromagnet *10*.

4689	ELECTRIC PRESSURE-MEASURING MECHANISM FOR PRESSES	CE M



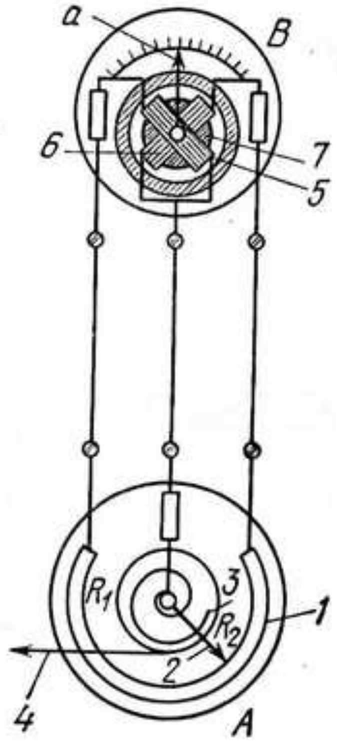
When worm *1* rotates about fixed axis *A*, screw *3* (Fig. *a*), on which worm wheel *2* is rigidly mounted, rotates about fixed axis *B* and displaces weight *5* along lever *4*, thereby varying the pressure exerted by the press. By means of worm *6*, rotation of screw *3* is transmitted, at the same time, to worm wheel *7*, which rotates about fixed axis *C* and advances the slide of rheostat *8* (Fig. *b*). The resistance of the rheostat is proportional to the pressing pressure. The measuring instrument (Fig. *b*) is graduated in pressure units.

4690	PIEZOELECTRIC-TYPE CUTTING FORCE MEASURING MECHANISM	CE M



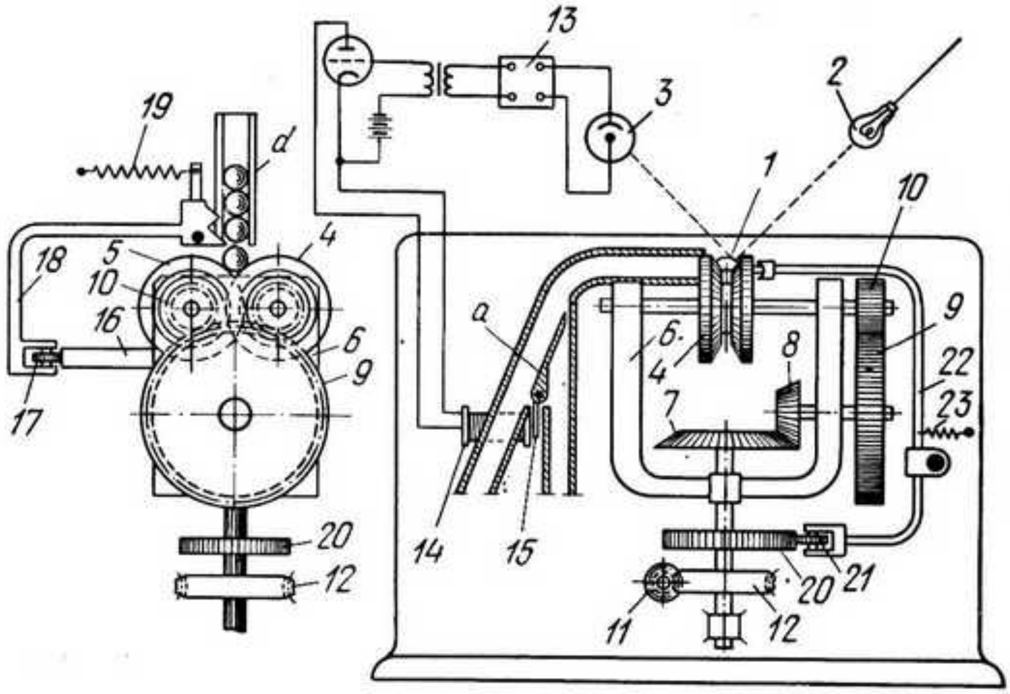
The single-point lathe tool is clamped in holder *1*, and the three components of the cutting force are] sensed by piezoelectric pickups *2*, *3* and *4*. Each pickup consists of two quartz wafers which are compressed in the direction of their electrical axes. One of the electrodes of each pickup is a metal plate, sandwiched between the quartz wafers and carefully insulated from the other parts of the device. The second electrode is holder *1*. The vertical component (tangential force) is sensed by pickup *2*, axial component (radial force) by pickup *3* and the lateral component (feed force) by pickup *4*.

4691	POTENTIOMETER-TYPE FLAP POSITION INDICATOR MECHANISM FOR AIRCRAFT	CE M



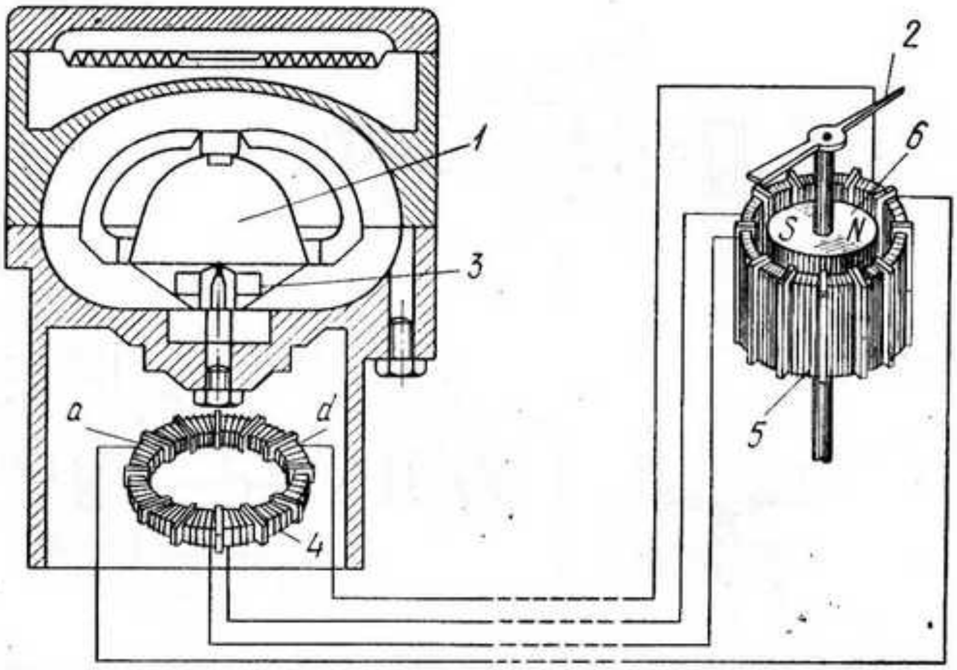
Pickup *A* of the instrument is potentiometer *1* along which slider *2* slides. Slider *2* is linked through pulley *3* and wire rope *4* to the flap mechanism (not shown). Upon a change in the position of the flaps, slider *2* is displaced, changing the resistances R_1 and R_2 of the potentiometer arms. This changes the current in coils *5* and *6* of a logometer with moving magnet *7*. The fields of coils *5* and *6* interact with that of permanent magnet *7*, turning the magnet and hand *a*, rigidly attached to the magnet, to the position in indicator *B* that corresponds to the position of the flaps.

4692	AUTOMATIC PHOTOELECTRIC MECHANISM FOR BEARING BALL SURFACE QUALITY INSPECTION	CE M



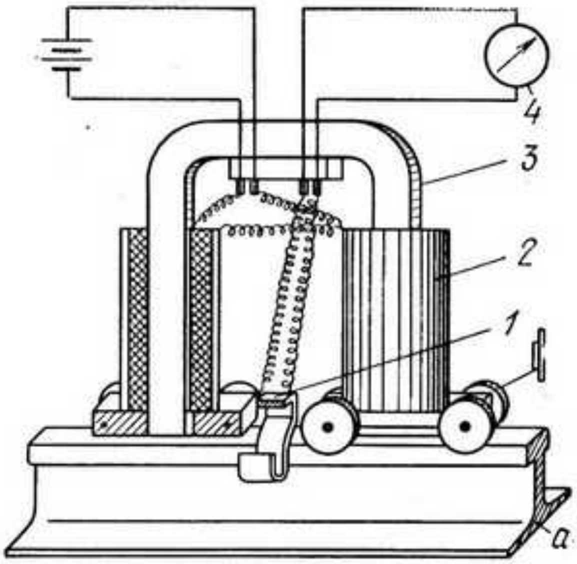
Ball *1* being inspected is illuminated by a beam of light from source *2*. Ball *1* is turned in all directions, so that the light beam reaches all points of its surface, by turning rollers *4* and *5*, which are driven by gears *7*, *8*, *9* and *10*. Roller *4* has a vee-shaped groove in which the ball being inspected rests. Roller *5*, of cylindrical shape, supports the ball. Ball *1* is turned simultaneously in two mutually perpendicular planes because rollers *4* and *5*, besides rotating about their axes, also rotate together with yoke *6* about the vertical axis of the yoke, which is driven through worm *11* and worm wheel *12*. The shafts of rollers *4* and *5* run in bearings of yoke *6*. The luminous flux is reflected by the surface of the ball to the cathode of photoelectric tube *3*. Any variation in the reflection factor (reflectance) of light, due to a defect on the polished surface of the ball, leads to a change in the photocurrent. This, after being amplified by amplifier *13*, is converted into a current pulse that energizes the winding of electromagnet *14*. Armature *15* of the electromagnet is linked to gate member *a*, turning it to direct each ball either to the within-specifications box or to the reject box. Cam *16*, rotating together with yoke *6*, turns lever *18* by means of roller *17*. Lever *18* releases the balls, one by one, from feed tube *d*. Spring *19* holds roller *17* in contact with cam *16*. Cam *20*, rotating together with yoke *6*, turns lever *22* by means of roller *21*. Lever *22* ejects ball *1* after inspection from rollers *4* and *5*. Spring *23* holds roller *21* in contact with cam *20*.

4693	ELECTROMAGNETIC REMOTE-READING COMPASS MECHANISM	CE M



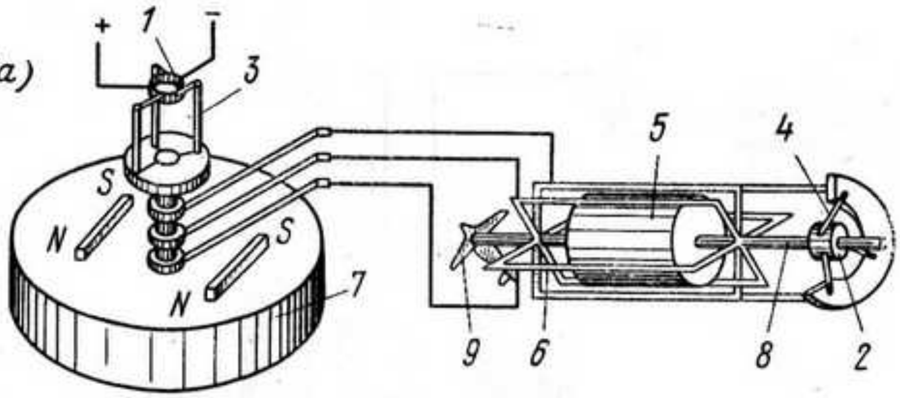
The pickup of this system is toroidal member *4*, having a uniformly distributed open-circuit winding, which has an a-c supply. The winding has two taps, *a* and *d*, at angles of 120° and 240° from the supply input leads. Compass magnetic system (card) *1* is located separately, directly above toroidal member *4*. Card *1* consists of annular magnet *3* having a high magnetic torque. The remote-reading indicating instrument has similar toroidal member *5*, whose winding is connected with the corresponding sections of the winding of toroidal member *4* in the pickup. Arranged inside toroidal member *5* of the indicator is round magnet *6*, mounted rigidly on a common shaft with hand *2* (which indicates the angle of rotation of card *1*). The voltages between the sections of toroidal member *4* are distributed in accordance with the position of compass card *1*. The corresponding currents in the leads connecting the windings of toroidal members *4* and *5* affect core *6* of member *5* in the indicator. As a result, moving magnet *6* turns to the position that corresponds to that of compass card *1*.

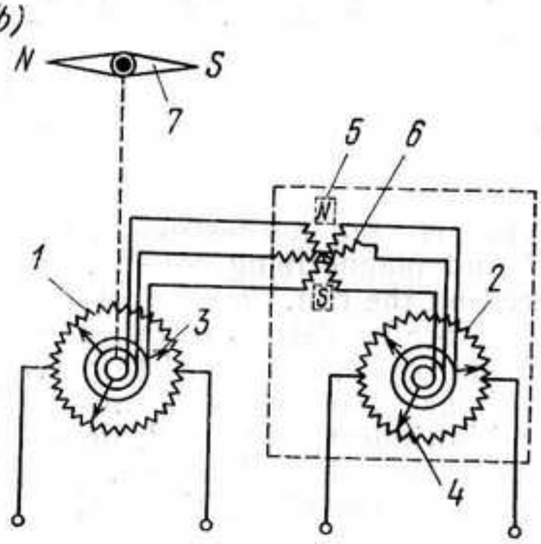
4694	ELECTROMAGNETIC FLAW DETECTOR MECHANISM FOR RAILS	CE M



This flaw detector is used for testing railway rails. Movable detecting coil 1 and magnetizing coils 2, energized by direct current, are placed on the rail. Core 3 provides a closed magnetic circuit. If there are no defects in rail *a*, then upon uniform traverse of detecting coil 1, connected to galvanometer 4, there is no deviation of the galvanometer hand. If there are hidden flaws (fissures or blowholes) in the rail, deviation of the galvanometer hand indicates their location, and the amount of hand deviation, their size.

4695	POTENTIOMETER-TYPE REMOTE-READING COMPASS MECHANISM	CE M

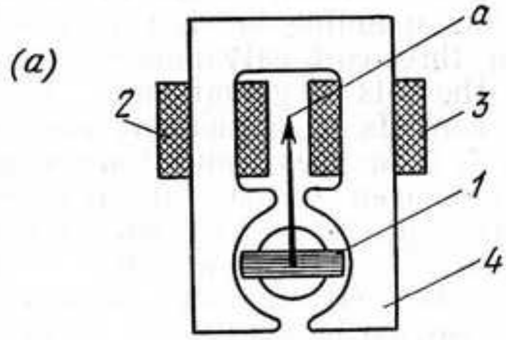


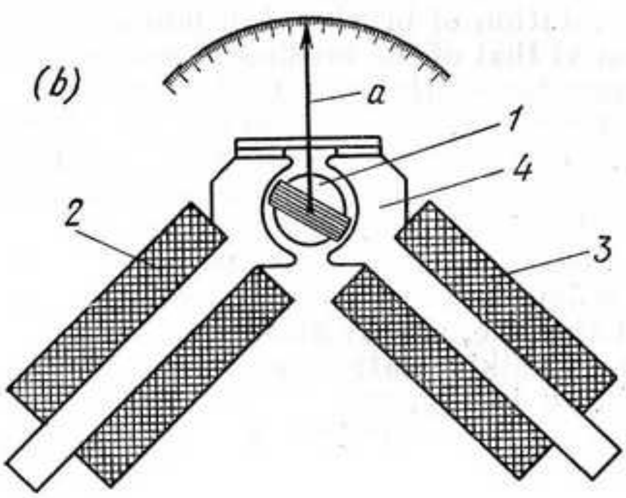


4695	POTENTIOMETER-TYPE REMOTE-READING COMPASS MECHANISM	CE M

The remote-reading compass consists of two potentiometers, *1* and *2*, moving in each of which are three brushes arranged at angles of 120° from one another. Brushes *3* of potentiometer *1* are connected to corresponding brushes *4* of potentiometer *2*. The windings of a three-coil galvanometer are connected in the leads between the sets of galvanometer brushes *3* and *4*. The galvanometer consists of permanent magnet *5* inside of three moving coils *6*. If brushes *3* and *4* are at points of equal potential, there is no current in the connecting leads. Brushes *3* are linked to magnetic needle *7* of the compass. When needle *7* and, consequently, brushes *3* turn through a certain angle, producing a current in the galvanometer windings, coils *6*, by means of lever *8*, displace brushes *4* of potentiometer *2*. The galvanometer windings are connected into the leads in such a way that the rotation of brushes *4* of potentiometer *2* is in the same direction as that of the brushes in potentiometer *1*. Coils *6* of the galvanometer continue to displace brushes *4* of potentiometer *2* until the brushes reach points having the same potential as the points of brushes *3* of potentiometer *1*. The angle through which brushes *4* turn is equal to the angle of displacement of brushes *3* of potentiometer *1*. Thus, the angle of turn of magnetic needle *7* is transmitted to a distant point. The angle of turn indicator is designed as a disk with a reference line and small image *9* of an airplane, rigidly attached to moving coils *6* of the galvanometer. The kinematic diagram of the remote-reading compass is shown in Fig. *a*, and the electric circuit diagram, in Fig. *b*.

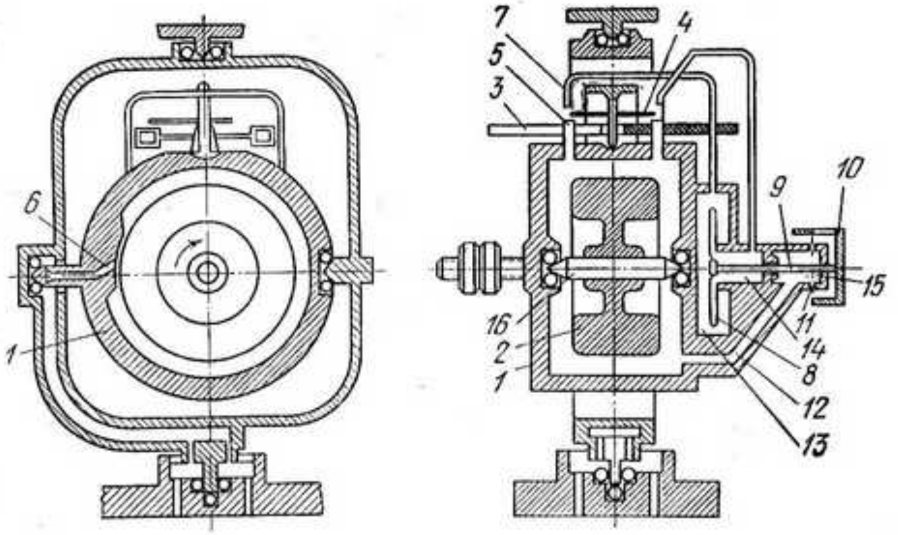
4696	FERRODYNAMIC D-C AMMETER MECHANISM	CE M





When coils *1*, *2* and *3* are energized, moving coil *1* turns. The electromagnetic field of stationary coils *2* and *3* is strengthened by permanent magnet *4*. The angle of rotation of moving coil *1*, indicated by hand *a*, depends upon the currents in the coils. An ammeter with a closed magnetic circuit is shown in Fig. *a*, and one with an open circuit, in Fig. *b*.

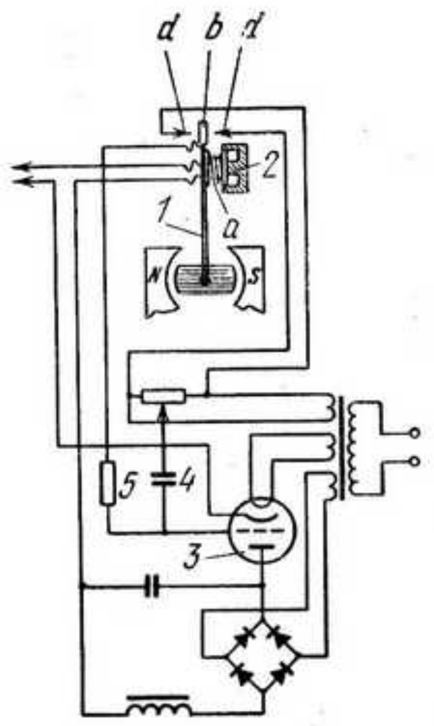
GYROMAGNETIC COMPASS MECHANISM



The principle of the gyromagnetic compass is based on the application of the properties of a gyroscope with three degrees of freedom. The axis of the gyroscope is corrected to the direction of the magnetic meridian. The reaction force of a stream of air is made use of to develop the directive force. The sensitive element holding the compass axis in the plane of the magnetic meridian is the magnetic system, consisting of two parallel magnets *3*, mounted on a vertical shaft. The correction system is located on the inner frame of a gimbal suspension, designed as airtight housing *1* containing rotor *2*. Magnetic system *3* rotates freely about a vertical axis and carries eccentric cam *4* under which are two air nozzles *5*, protruding from housing *1*. A line connecting the centres of the nozzles is parallel to the axis of rotor *2*. Rotor *2* is driven by an air jet flowing from nozzle *6*. A small part of this air is directed from housing *1* through two nozzles *5* and flows out past eccentric cam *4* in two air jets of equal force if magnets *3* are parallel to rotor shaft *16*. If the axis of rotor shaft *16* is not oriented along the magnetic meridian, one of nozzles *5* is opened more than the other and issues a stronger air jet. A pneumatic relay, amplifying the difference in pressure of the jets of air discharged by nozzles *5*, is used to improve the sensitivity of the compass. This relay has two opposed receiver nozzles 7, connected by tubes to airtight chambers *13* and *14*. The chambers are separated by rubber membrane *8*, whose centre can be displaced horizontally together with rod *9* and shutter *10*. Receiver nozzles 7 are subject to the pressure of the jets of air discharged from housing *1*. If one jet is stronger, the difference in pressure displaces membrane *8*

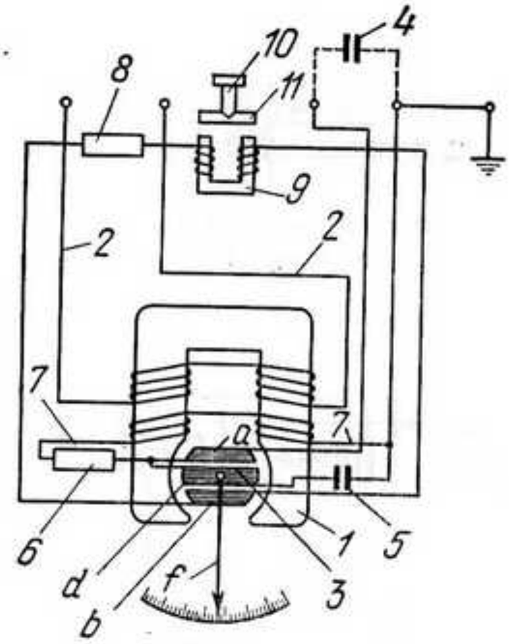
in the corresponding direction. The major part of the air in housing *1* is discharged through channel *12* into air chamber *15* from which it flows in two strong jets through two slotted openings *11*. Shutter *10* slides along these openings and closes them by one half when membrane *8* is in its middle position. When membrane *8* is bent to the right, shutter *10* closes the upper opening and opens the lower one, and vice versa. The air jet issued from corresponding opening *11* develops a reaction force causing precession of the gyroscope toward the magnetic meridian. As soon as the axis of the gyroscope coincides with the plane of the meridian, magnets *3* are parallel to the axis of rotor shaft *16*, and the pressure in the receiver nozzles, as well as in chambers *13* and *14*, is the same, because eccentric cam *4* covers the nozzles by equal amounts. Then membrane *8* and shutter *10* move to their middle position and precession of the gyroscope ceases because the reaction of the air jets is mutually counterbalanced. The horizontal direction of the gyroscope axis in the plane of the magnetic meridian is maintained by pendulum correction, similar in operation to artificial horizon correction.

4698	REMOTE-READING ELECTRONIC PICKUP MECHANISM	CE M

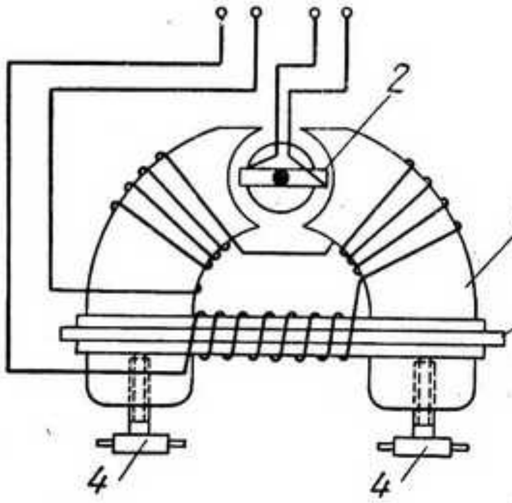


A torque proportional to the quantity being measured is applied to hand *1*, which carries coil *a* and contact *b*. Coil *a* moves in hollow magnet 2, and contact *b*, located at the end of hand *1* and connected to the grid of triode *3*, moves from one stationary contact *d* to the other. Stationary contacts *d* supply the positive or negative bias to change the anode current of tube *3*. Under normal conditions, the current in coil *a* is such that the torque it develops is counterbalanced by the torque developed by the quantity being measured. If this quantity and, consequently, the torque it develops vary, contact *b* of hand *1* turns to one of stationary contacts *d*. The anode current then begins to decrease or increase until the torques are balanced again and hand *1* is retracted from the corresponding contact *d*. Coil *a* is connected into the anode circuit of triode *3* which is closed through remote indicators and recording devices (not shown) that are connected in series. Capacitor *4* and resistor *5* are connected in parallel with the grid of lamp *3* to build up the required voltage. Thus, the system supplies the line with a direct current proportional to the quantity being measured.

4699 MICROFARADMETER MECHANISM CE M

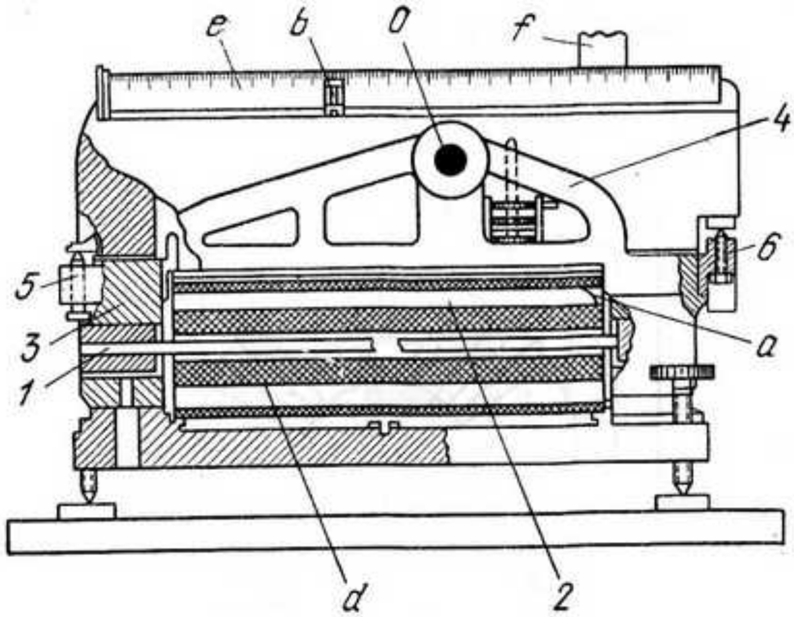


The field of electromagnet 1 with its exciting winding 2 contains movable system 3, consisting of three coaxially wound coils, a, d and b. Coils a and d are connected together in opposition. Capacitance 4 being measured is connected in series with coil a, and reference capacitance 5 is connected in series with coil d. These two circuits are connected through protective resistor 6 to winding 7 of electromagnet 1. Winding 7 is the secondary winding of a transformer whose primary is winding 2. The current in winding 2 is inductive; that in coils a and d is capacitive. As a result of transformation, these currents are shifted in phase by 180°, so that the supply current in winding 2 and the current in movable system 3 are in phase, thereby developing a substantial torque. Since coils a and d are connected in opposition, the instrument measures the difference in currents in capacitance 4 and in capacitance 5, used for comparison. The counteracting torque, applied to movable system 3 to which hand f is rigidly attached, is obtained electrically, owing to the current induced in the winding of movable system 3. The source of this current is the variable field of electromagnet 1. The counteracting torque developed by this current depends in the same way on the current in winding 2 as does the torque due to the currents in coils a and d. Hand f is set to zero by adjusting armature 11 of inductor 9 by means of screw 10. Inductor 9 and resistor 8 are connected into the winding circuit of coil b.



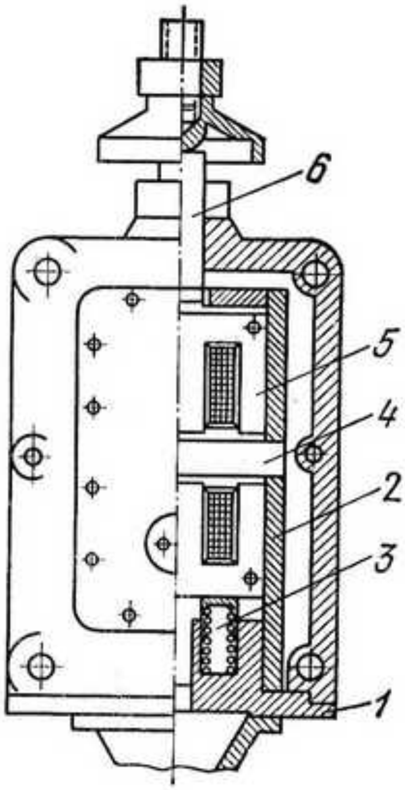
The permeameter serves to measure magnetic induction. The electrodynamic permeameter is based on the principle of an electrodynamic device, i.e. on the phenomenon of mechanical interaction of the magnetic field set up by magnetized specimen *1* with the electromagnetic field set up by current in the winding of moving coil *2*. As a result of this interaction, moving coil *2* is deviated from its equilibrium position. The angle through which coil *2* deviates is an indication of the magnetic induction of test specimen *1*, which is clamped in yoke *3* by screws *4*.

4701	ELECTROMAGNETIC BALANCE MECHANISM	CE M



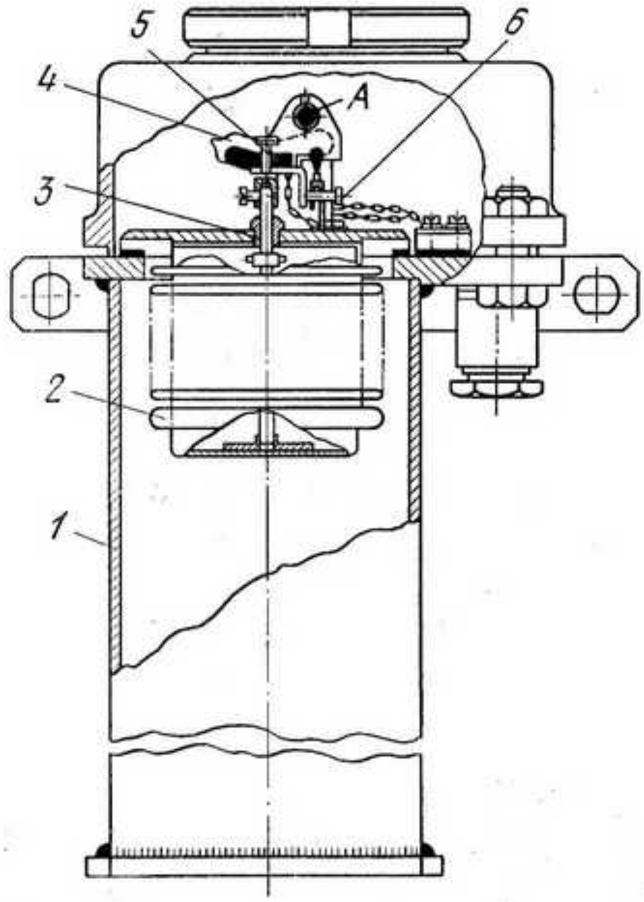
The electromagnetic balance serves to measure magnetic induction. Workpiece *1*, whose magnetic induction is to be measured, is inserted into magnetizing coil *2*, made up of two coils, *a* and *d*, wound on each other and connected in series in such a manner that the fields they set up are opposed. When coil *2* is energized, workpiece *1* and frame *3* are magnetized, developing attractive forces between the ends of steel beam *4* and the frame. Acting on the unequal arms of beam *4*, these forces turn the beam about fixed axis *O*. The moments of these forces can be balanced by means of weights *f* and *b*, sliding them along scale *e*. The attractive force between frame *3* and beam *4* can be determined from the masses and positions of weights *f* and *b*. This force is proportional to the magnetic induction. Adjusting screws *5* and *6* set up the amplitude of swing of beam *4*. The balance is initially calibrated by weight *f*.

4702	TSNIITMASH INDUCTANCE PICKUP MECHANISM FOR BAND TENSION MEASUREMENT DURING ROLLING	CE M



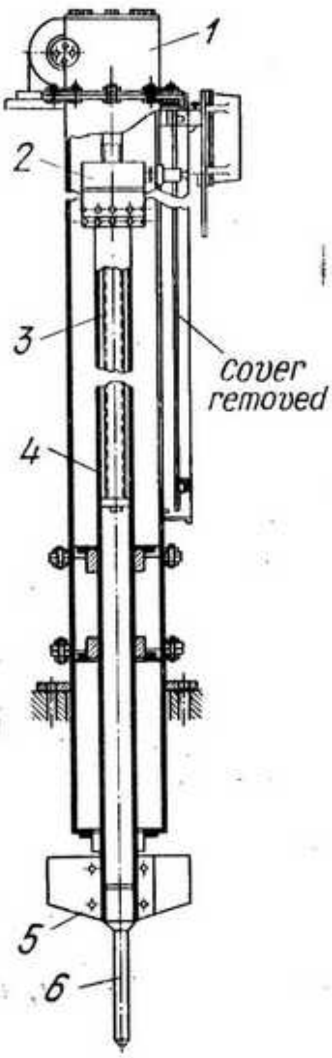
Two steel plates *2* with guide slots are secured to bottom cover *1* of an airtight housing. Two magnetic circuits *5*, with coils connected together by welded brass frames, can move along the guide slots of plates *2*. Below, magnetic circuits *5* are subject to the force exerted by springs *3*, and above, by the force exerted by rod *6*, which is rigidly attached to the movable bearing of the rolling mill stand. The magnetic circuits are closed by plate *4*, which is rigidly attached to plates *2*. Upon changes in the tension of the band being rolled, leading to displacement of rod *6*, the air gap between the upper magnetic circuit and the fixed armature (plate *4*) is reduced and that between the lower magnetic circuit and the same armature is increased. This changes the emf, which is indicated by suitable apparatus.

4703	MERCURY-CONTACT LIQUID LEVEL INDICATOR MECHANISM	CE M



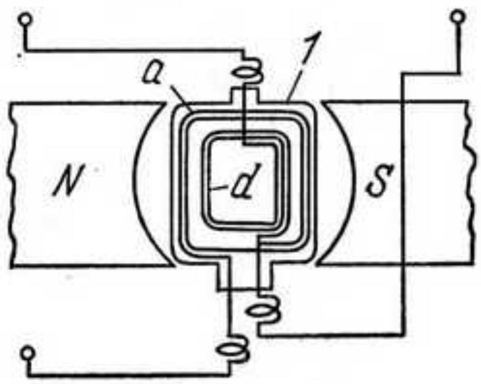
The lower end of pipe *1* is immersed in the liquid whose level is to be controlled. Upon an increase in the height of the liquid level, the pressure in pipe *1* increases, compressing sylphon *2*. Rod *3*, linked to sylphon *2*, turns glass mercury switch *4* about fixed axis *A*. When the contacts of switch *4* close, a signal is transmitted to the indicating or recording device. The liquid level at which switch *4* is opened or closed is regulated by screws *5* and *6*.

4704	ELECTRICALLY POWERED LOOSE MATERIALS LEVEL INDICATOR MECHANISM	CE M



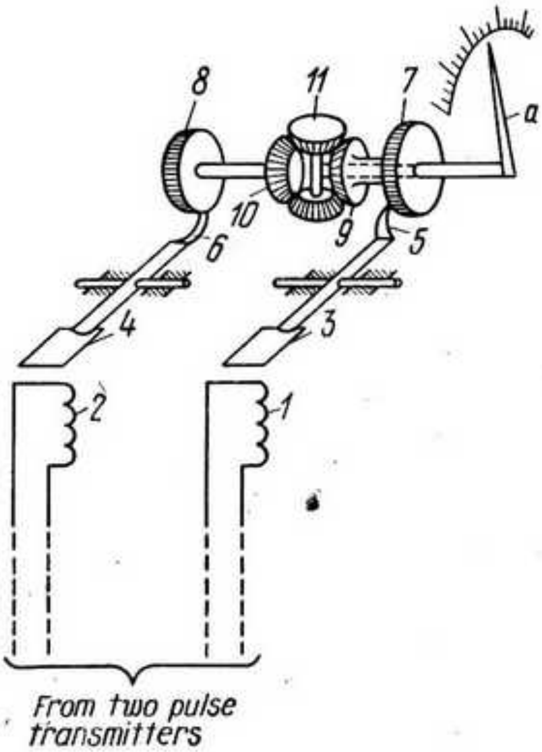
Through reducing gear *1* an electric motor continuously rotates screw *3*. Mounted on the upper end of tube *4* are a nut and sleeve *2*, which has a roller sliding in fixed guides and deviating a control wedge when it travels up or down. Tube *4*, with vanes *5* and probe *6*, tends to descend by gravity along the non-self-locking (quick-pitch) thread of screw *3*, the tube rotating in the same direction as screw *3*. When probe *6* reaches the surface of the loose material, tube *4* stops descending, and when vanes *5* interact with the material, the tube begins to rotate more slowly than screw *3*. At this, the nut begins to rise on screw *3*, lifting tube *4*, until the resistance to rotation of the vanes is reduced again. In the upward and downward travel of tube *4*, the roller of sleeve *2* actuates the control wedge, transmitting electric signals to the level control system.

4705	MAGNETOELECTRIC (MOVING-COIL) ADDING MECHANISM FOR ELECTRICAL QUANTITIES	CE MO



This mechanism is based on the principle of a magnetoelectric device on whose moving coil *1* several windings, *a*, *d*, etc., according to the number of addends, are superposed. The angle of deviation of coil *1* is proportional to the sum of the currents in each of windings ***a***, ***d***, etc.

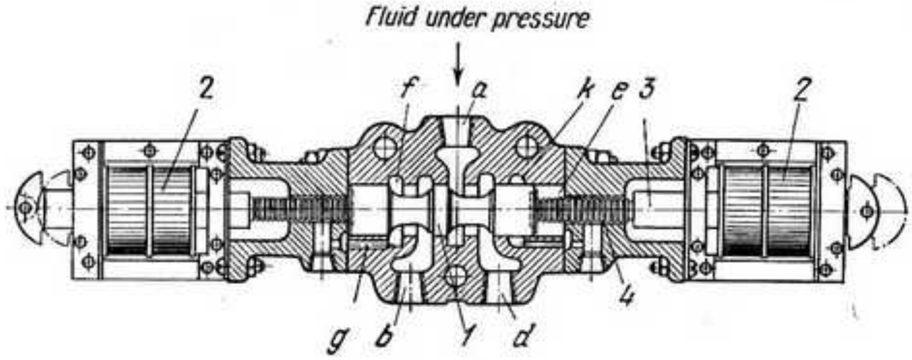
4706	MAGNETOELECTRIC (MOVING-COIL) ADDING MECHANISM FOR ELECTRICAL QUANTITIES	CE MO



Pulses from two transmitters are received by the windings of two magnetoelectric instruments, *1* and *2*, whose moving coils, *3* and *4*, are linked to pawls *5* and *6*. These pawls drive ratchet wheels *7* and *8*, which are rigidly linked to bevel gears *9* and *10* of bevel differential gearing *11*. The shaft of the carrier of gearing *11*, together with hand *a*, rigidly mounted on the shaft, turns through an angle equal to the algebraic sum of the angular displacements of the shafts due to the action of the two transmitters.

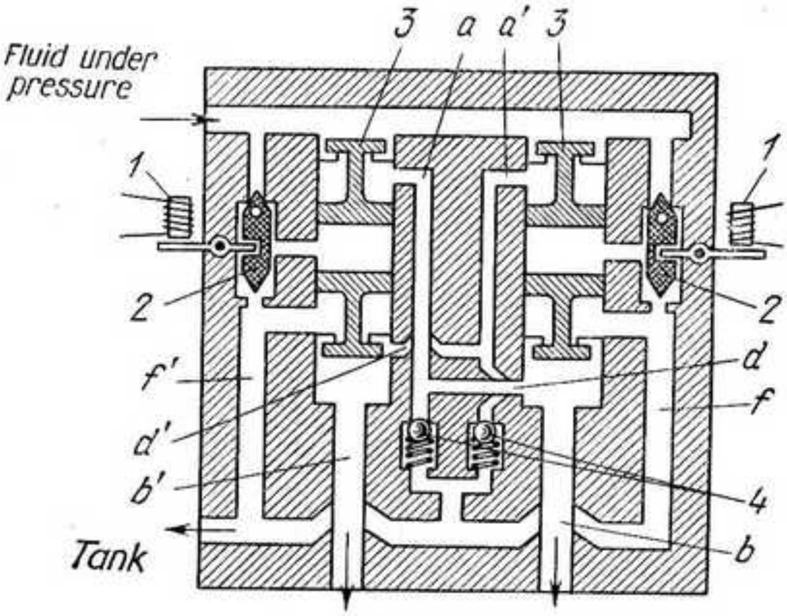
4. FLOW-CONTROL AND DIRECTIONAL VALVE MECHANISMS (4707 and 4708)

4707	SPOOL-TYPE ELECTROHYDRAULIC DIRECTIONAL VALVE MECHANISM	CE FC



Spool *1* is shifted by advance solenoids *2*, switched on alternately. Core *3* of the solenoid whose winding **is** energized pushes rod *4* which shifts spool *1*. Fluid under pressure is delivered to port *a*. In the position shown, spool *1* has been shifted to the left and the fluid is directed to port *d* and further to the working end of the power cylinder. Fluid from the exhaust end of the cylinder is discharged through port *b* into recess *f* which is connected, like recess *k*, to the fluid tank. When spool *1* is shifted to the right, fluid from port *a* is directed to port *b*, and fluid from the hydraulic system flows through port *d* to recess *k* and further to the tank. Channels *g* are provided to eliminate fluid leaking into spaces *e* at the ends of the spool.

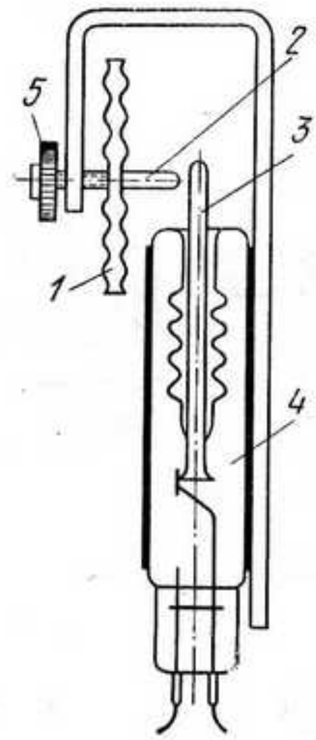
ELECTROHYDRAULIC DIRECTIONAL VALVE MECHANISM



Power cylinder

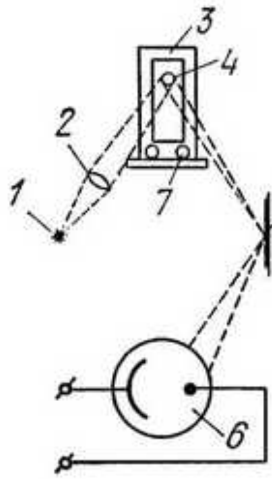
When the winding of one of electromagnets *1* is energized, the corresponding pilot valve (servovalve) *2* is shifted downward, admitting fluid under pressure to the recess between main valve spools *3*. At this, the spools shift in opposite directions, admitting fluid through channels *a*, *d* and *b* to one of the ends of the power cylinder, depending upon which of electromagnets *1* is energized. The other end of the power cylinder is connected to the tank through channels *b'* and *f'*. Relief valves *4* serve to protect the system against excess pressure.

4709	VACUUM-SWITCH ROOM TEMPERATURE REGULATOR MECHANISM	CE Rg



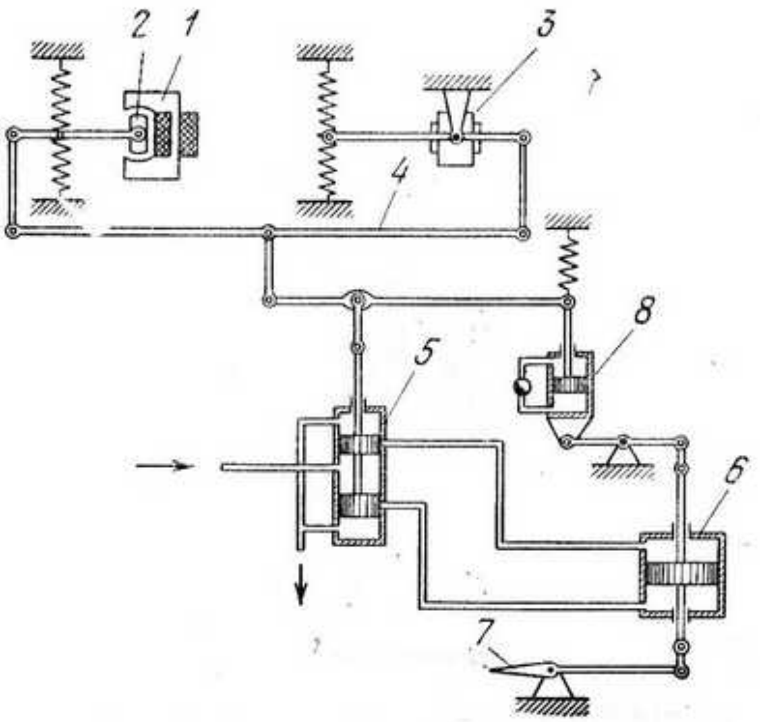
When the temperature rises, aneroid capsule *1*, filled with the saturated vapour of a liquid, expands. Upon reaching the preset temperature, rod *2* of the capsule presses operating pin *3* of vacuum switch *4*, which controls the heating facilities. The temperature at which the regulator operates can be set by adjusting screw *5*.

4710	PHOTOELECTRIC TEMPERATURE REGULATOR MECHANISM	CE Rg



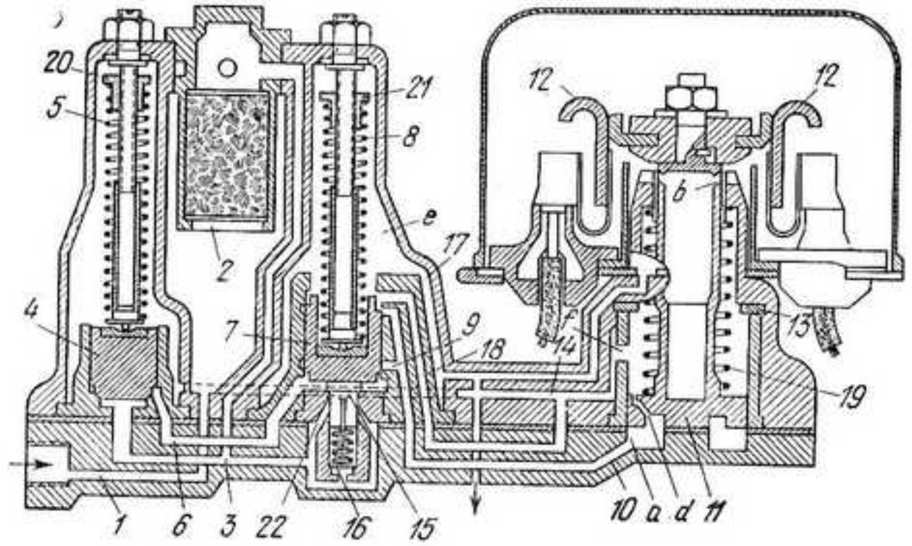
A beam of light from source *1* passes through lens *2* and is reflected by mirror *4* of galvanometer *3* to fixed mirror *5*, from where it is reflected to phototube *6*. Thermocouple *7*, connected into a circuit with galvanometer *3*, is used to measure the temperature being controlled. When the temperature varies, the current in the thermocouple is changed, turning mirror *4* of the galvanometer. This changes the illumination of phototube *6* and, consequently, the photoelectric current by means of which the heating facilities are controlled.

4711 | **MAGNETIC-COMPASS-TYPE AIRCRAFT YAW STABILIZING MECHANISM** | CE Rg



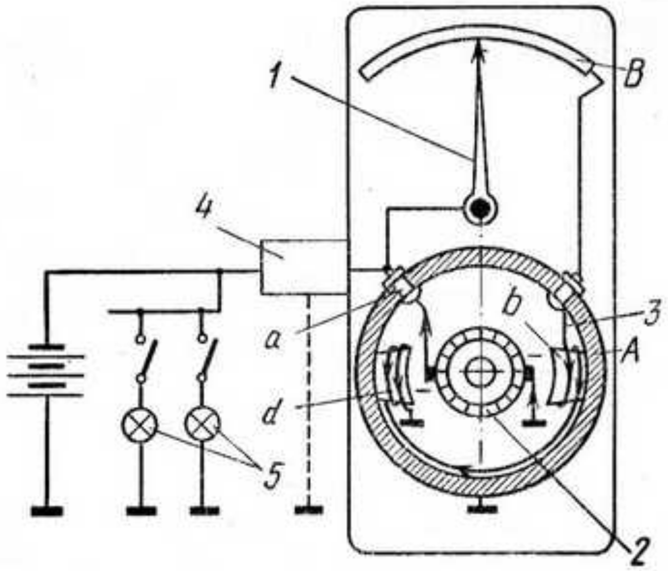
Deviation of the aircraft from the preselected course is measured by a magnetic compass that actuates electromagnet *1*. Armature *2* of the electromagnet turns through an angle proportional to the deviation of the aircraft from the course. The angular velocity of deviation of the aircraft is measured by gyroscope *3*. Armature *2* of the electromagnet and the ring of gyroscope *3* are linked by turning pairs to summing lever *4*, to which pulses are transmitted by both sensing elements simultaneously or by each separately. When lever *4* is displaced, it shifts the spool of valve *5* and fluid from this valve is directed to the corresponding end of servomotor *6*, which controls rudder *7*. Flexible feedback is accomplished in the mechanism by means of cataract *8*.

4712	ELECTRIC-CONTACT AIR PRESSURE REGULATOR MECHANISM	CE Rg



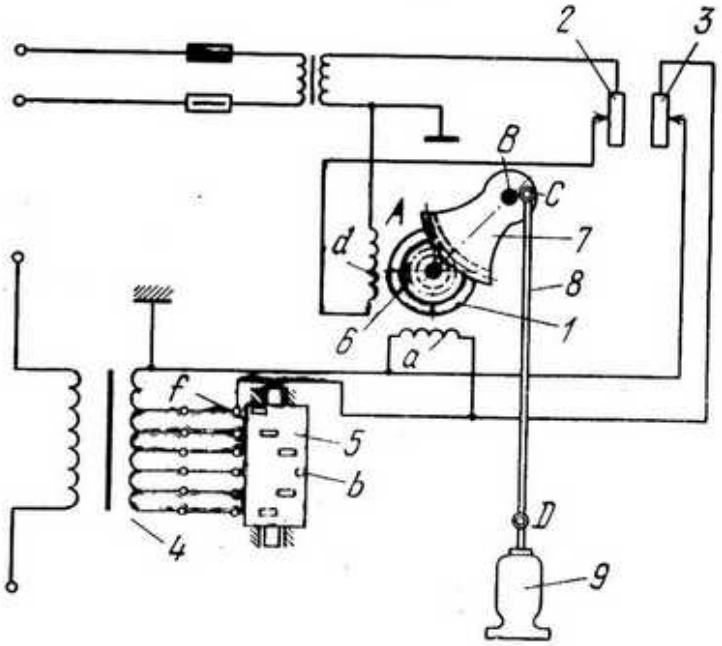
The mechanism is intended for controlling the air pressure in a system by closing or opening the circuit of an electric motor that drives an air compressor. In the position shown of the elements of the regulator, the compressor is switched on. Compressed air is delivered from the tank through port *1*, air cleaner *2* and channel *3*. When the pressure in the system exceeds the preset value, valve member *4* is raised, overcoming the resistance of spring *5* and admitting compressed air through channel *6* to valve member *7*. This raises valve member *7*, overcoming the resistance of spring *8* and admitting air through channels *9* and *10* to space *a* under piston *11*. As piston *11* moves upward, it opens the contacts at *12*, switching off the compressor. Compressed air is discharged through hole *d* in the piston, the hollow piston rod and holes *b* to the arcs formed in opening the contacts. The air quenches the arcs. In the upper position of piston *11*, hole *d* is closed by component *13*, and air no longer passes through the hollow rod. Air from space *a* passes through port *f* and channel *14* to the space above valve member *4*. This equalizes the air pressure above and below valve member *4*, after which spring *5* closes the member. At this, air from the tank passes to space *a* through channels *3* and *22*, and then through valve *15*, which is opened by the air pressure and the action of spring *16*, and further through channels *9* and *10*. The contacts at *12* remain open until the pressure in the system drops to the preset value. Then spring *8* shifts valve member *7* downward, actuating valve *15*. As valve *15* moves downward, it closes the passage between the tank and space *a*. Air from space *a* passes through channel *10* into space *e* and further, through channel *17* to the atmosphere. Besides, air is also discharged through hole *f* and channel *18*, enabling piston *11* to shift downward more rapidly. Spring *19* shifts piston *11* downward, closing the contacts at *12* and thereby switching on the compressor. The maximum permissible air pressure in the system is regulated by nut *20*, which compresses spring *5* of the switch-off valve member *4*. The minimum air pressure is regulated by nut *21*, which compresses spring *8* of switch-on valve member *7*. This arrangement allows any pressure drop to be set up.

4713	GENERATOR VOLTAGE REGULATOR MECHANISM FOR AN AUTOMOBILE	CE Rg



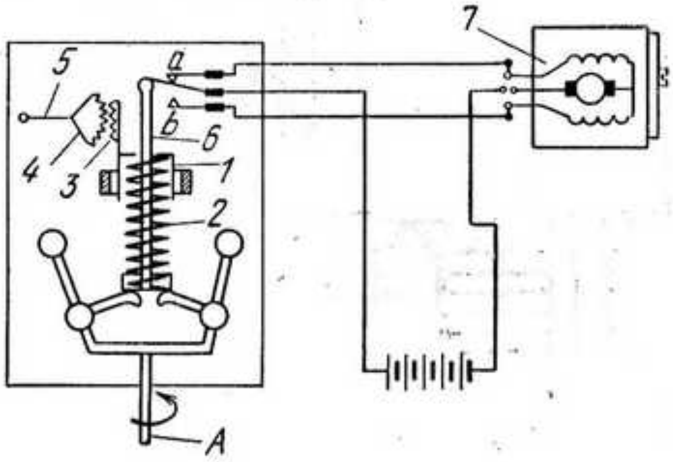
The mechanism serves to maintain a constant voltage over terminals *a* of generator *A* when the speed of generator rotor *2* varies. The voltage over the generator terminals is proportional to the rotor speed and to the magnetic flux between poles *d* and *b*. Therefore, to maintain constant voltage of the generator at an increased rotor speed, it is necessary to vary the magnetic flux between poles *d* and *b* in an inverse proportion to the rotor speed. This can be done by changing the field current of the generator, connecting rheostat *B* in series into the circuit of field winding *3*. When rheostat lever *1* is turned to the left to increase the resistance, the field current and magnetic flux are reduced, thereby reducing the voltage over generator terminals *a*. A kinematic mechanism (not shown), for example, of the speedometer type, links rotor *2* and rheostat lever *1*. Shown schematically at the left are reverse-current relay *4* and power consumers *5*.

4714	POWER OUTPUT REGULATOR MECHANISM FOR A STEAM TURBINE	CE Rg



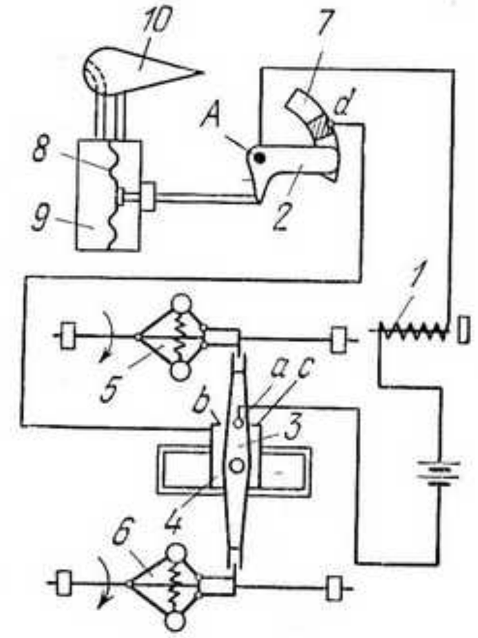
Regulation is accomplished by adjusting the steam distribution facilities of the turbine. The sensing element of the regulator is a wattmeter consisting of potential winding *a* and current winding *d*, which develop a torque on aluminium disk *1* that depends upon the power output being regulated. Regulating rheostats *2* and *3* are used to set up the instrument. A variable number of turns of adjustable transformer *4* can be switched into the circuit of winding *a* of the regulator by turning the drum of controller *5*. At this, plates *b* of the controller drum close various combinations of contacts *f*, correspondingly changing the voltage of the secondary winding of transformer *4*. Aluminium disk *1*, turning about fixed axis *A*, transmits rotation to segment gear *7* through gear *6*, rigidly attached to the disk. Segment gear *7* turns about fixed axis *B*. Tie-rod *8* is connected by turning pairs *C* and *D* to segment gear *7* and to the spool of hydraulic valve *9*. When segment gear *7* turns, it operates valve *9* of the hydraulic system that controls the steam distribution mechanism of the turbine.

4715	CENTRIFUGAL-GOVERNOR ELECTRIC-CONTACT PROPELLER-PITCH CONTROL MECHANISM	CE Rg



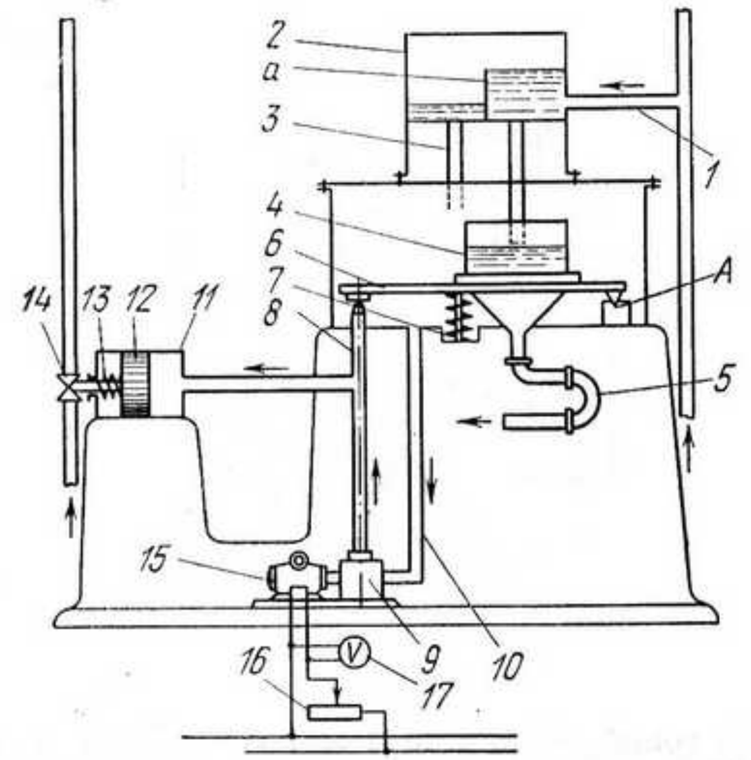
Shaft *A* of the centrifugal governor is driven by the aircraft engine. By means of gear rack *3* and segment gear *4*, washer *1* of spring *2* is linked to control lever *5*. Lever *5* is used for manually controlling the engine speed by varying the preload of spring *2*. The sleeve of the governor is rigidly attached to rod *6*, which closes one of the pairs of contacts controlling electric motor *7*, used for changing the propeller pitch. When the engine runs at the preset speed, rod *6* is in its middle position and both pairs of contacts are open. When the engine speed increases, rod *6* moves upward, closing the contacts at *a*, electric motor *7* begins to rotate, increasing the propeller pitch and, thereby, reducing the engine speed. When the engine speed drops, the contacts at *b* are closed and electric motor *7* rotates in the reverse direction, reducing the propeller pitch.

4716	ELECTRIC-CONTACT PROPELLER-THRUST SYNCHRONIZER MECHANISM FOR MULTIENGINED AIRCRAFT	CE Rg



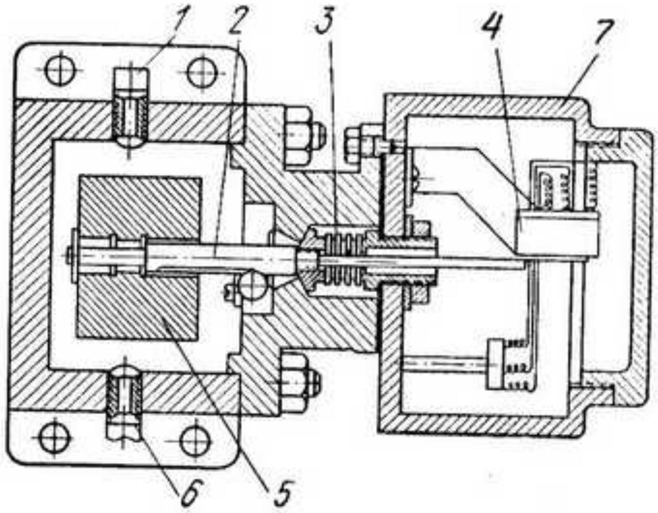
Winding *1* is connected to axle *A* of lever *2* and to contact *a*. Contact *a* is secured on lever *3*, which is connected by a turning pair to slider *4*. Slider *4* carries contacts *b* and *c*. Lever *3* is linked to the sleeves of centrifugal governors *5* and *6*, which are driven by their corresponding engines. Contacts *b* and *c* are connected to contact *d* on guide *7* along which lever *2* slides. This lever is turned by the bending of membrane *8*, mounted in chamber *9*, connected by tubes transmitting the static and dynamic air pressure from pitot tube *10*. After take-off, the dynamic pressure of the air is sufficient to close the contacts at *d* by lever *2*. When the speed of one of the aircraft engines drops, lever *3* turns and closes contacts *a* and *b* or *a* and *c*, winding *1* is energized and the symmetrical engine is switched off. If the speeds of the engines vary synchronously, lever *3* moves with slider *4* without turning and closing either of the two pairs of contacts, *a* and *b* or *a* and *c*.

4717	TYAGUNOV PAPER PULP CONSISTENCY REGULATOR MECHANISM WITH A VARIABLE-SPEED ELECTRIC MOTOR	CE Rg



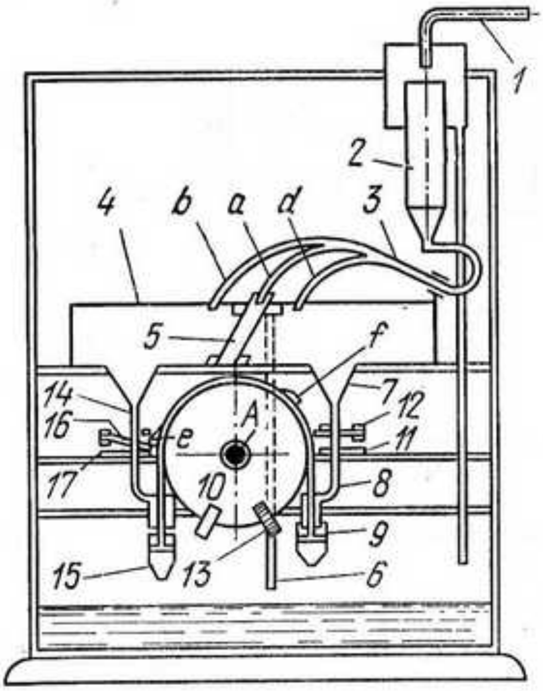
A certain amount of paper pulp is delivered by pipeline *1* to overflow box *2* with partition *a*, which serves to maintain a constant level of the pulp. Surplus pulp drains out through pipeline *3*. From the other half of overflow box *2*, the pulp flows down into vessel *4* from which it flows out freely through pipeline *5*. Vessel *4* is mounted on plate-like lever *6*, which rests on knife-edge *A* and is supported by spring *7*. The free end of lever *6* operates as a shutter for nozzle *8*, to which liquid is delivered by pump *9*. The liquid returns to the pump through pipe *10*. A part of the liquid is delivered to servomotor *11*, whose piston *12* has its rod linked to valve *14* of the water supply pipeline. When the consistency of the pulp increases, the weight of vessel *4* also increases and the shutter approaches nozzle *8*. This increases the resistance to the flow of liquid and the pressure of the liquid delivered by pump *9* also increases. At this, piston *12* is moved to the left by the pressure of the liquid, overcoming the resistance of spring *13* and opening valve *14*. This increases the amount of water delivered for mixing with the paper pulp. Upon a decrease in consistency, the elements of the regulator operate in the reverse direction. The regulator is set up to the required consistency by changing the speed of electric motor *15*. This is done by turning the lever of rheostat *16*, connected into the power supply circuit of motor *15*. The scale of voltmeter *17* is graduated in per-cent consistency. A change in the speed of motor *15* changes the liquid pressure in the system, piston *12* is displaced and valve *14* is turned to a different position.

4718	MICROSWITCH LIQUID-LEVEL REGULATOR MECHANISM	CE Rg



The float chamber is connected by tubes *1* and *6* to the vessel in which the level is to be controlled. Holder *2* carries float *5*. The float chamber is sealed by sylphon *3*, which allows holder *2* to be turned. Moisture-proof housing *7* contains microswitch *4* whose pin is actuated by the right end of holder *2*. When the liquid level rises above or drops below the axis of the instrument, the contacts of microswitch *4* are switched over by holder *2*.

4719	POLYAKOV ELECTRIC-CONTACT PAPER PULP CONSISTENCY REGULATOR MECHANISM	CE Rg

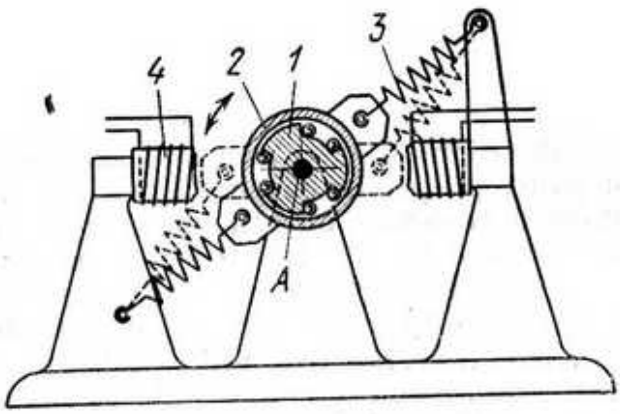


4719	POLYAKOV ELECTRIC-CONTACT PAPER PULP CONSISTENCY REGULATOR MECHANISM	CE Rg

The principle of the regulator is based on the change in the path of a stream of paper pulp flowing out of a small hole when the head is maintained constant but the pulp consistency varies. Paper pulp is delivered by pipeline *1* to vessel *2* from which a stream flows out through tube *3*, having three branches, into trough *4*. When the pulp is of the proper consistency, it flows out through branch *a* into cell *5* from which it drains down through pipe *6*. When the pulp consistency is above the normal value, the stream flows out through branch *d* (before cell *5*) into funnel *7* and through tube *8* into cup *9*, which has a hole at its lower end. The increased weight of cup *9* turns disk *10* clockwise about fixed axis *A*, depressing key *12*. The key is pressed against contact *11*, switching on an electric motor, which lowers a shutter to reduce the amount of paper pulp being delivered to the facility for mixing it with water. This reduces the consistency to the normal value. After the pulp drains out of cup *9* through the bottom hole, the cup returns to the equilibrium position. At this, disk *10* is turned clockwise by counterweights *13*, opening the contacts at *11* and switching off the electric motor. When the pulp consistency is too low, the stream passes cell *5* and flows through branch *b* and tube *14* into cup *15*. This turns disk *10* counterclockwise so that its pin *e* depresses key *16*, forcing it against contact *17*. As a result, the direction of the current is reversed in the poles of the electric motor. The motor is reversed, raising the shutter and increasing the amount of paper pulp supplied for mixing until the required consistency is restored, the stream of pulp flows into cell *5* and the electric motor is switched off.

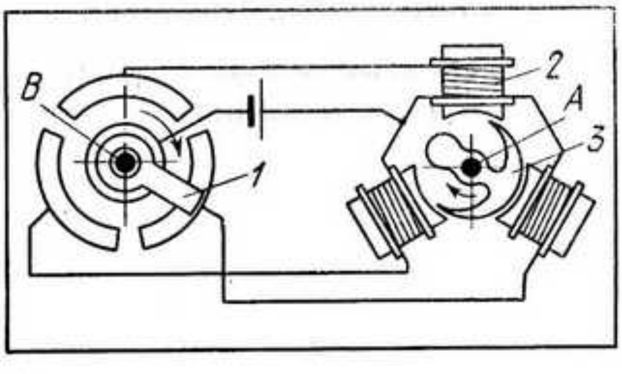
6. DRIVE MECHANISMS (4720 through 4726)

4720	ELECTROMAGNETIC DRIVE MECHANISM OF AN ELASTIC-LINK OSCILLATING ELECTRIC MOTOR	CE Dr



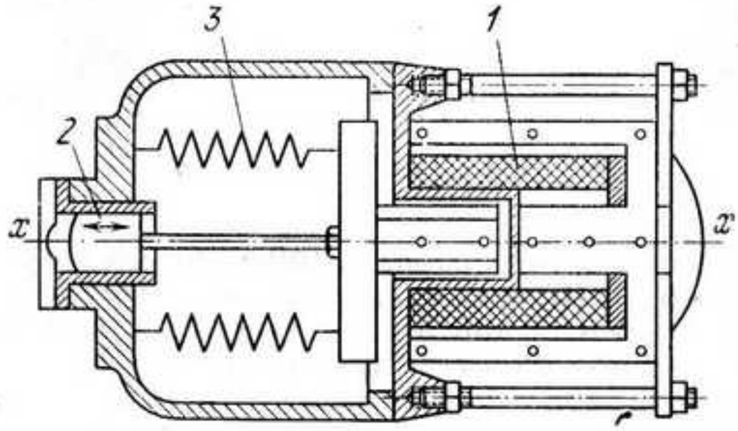
When the windings of rotor *1*, rotating about fixed axis *A*, are energized, stator *2* of the electric motor has an oscillating motion due to the magnetic field set up by electromagnets *4* and the action of springs *3*.

4721	ELECTROMAGNETIC TURNING MECHANISM	CE Dr



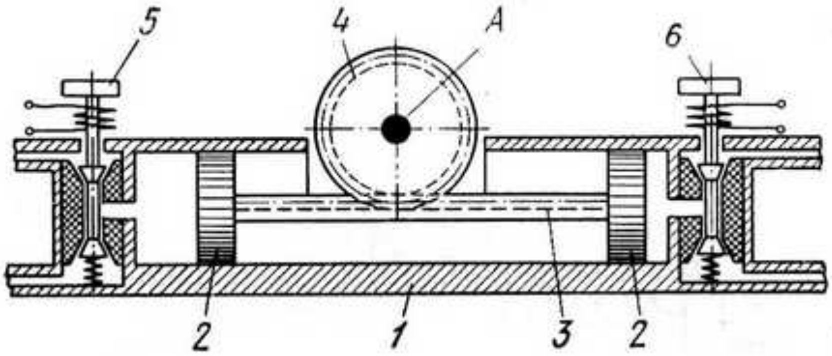
When crank *1* is rotated about fixed axis *B*, the windings of electromagnets *2* are consecutively energized and de-energized. This turns armature *3* about fixed axis *A*.

4722	ELECTROMAGNETIC ELASTIC-LINK COMPRESSOR DRIVE MECHANISM	CE Dr



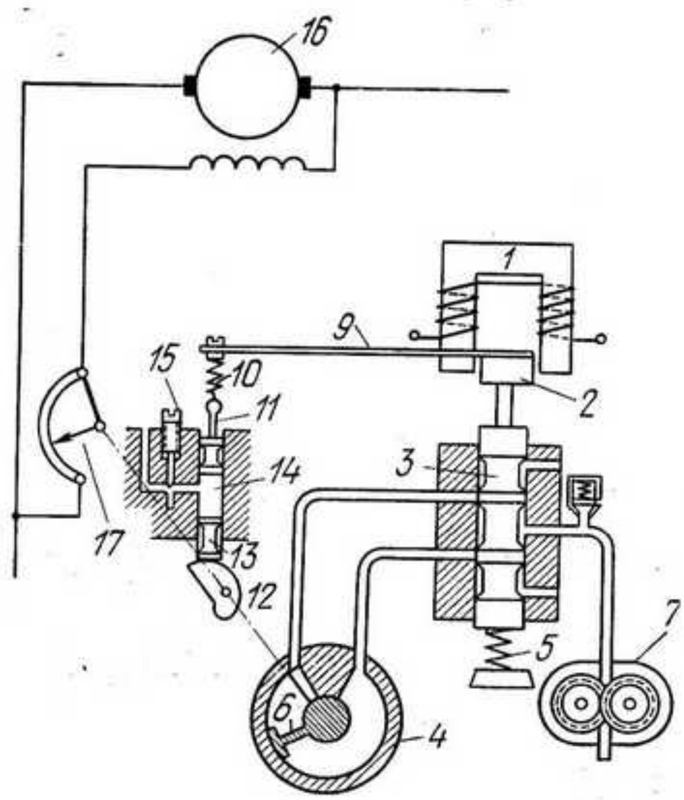
When the winding of electromagnet *1* is alternately energized and de-energized, compressor piston *2* is reciprocated along axis *x-x* by the action of the magnetic field of the electromagnet and that of springs *3*.

4723	ELECTROPNEUMATIC GROUP CONTROLLER DRIVE MECHANISM	CE Dr



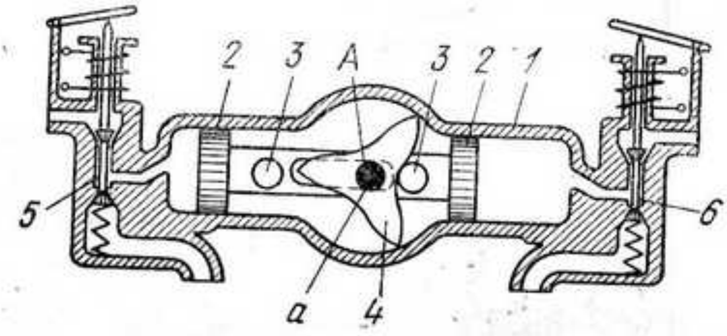
Cylinder *1* contains two pistons *2*, linked together by gear rack *3*, which meshes with gear *4*, turning about fixed axis *A*. Electromagnetic valves *5* and *6* are arranged at the two ends of cylinder *1*. The coils of these valves are connected into the control circuit. When the coils of the valves are not energized, valve *5* connects the left end of cylinder *1* to the compressed air receiver, and valve *6* connects the right end of cylinder *1* to the atmosphere. Thus, when the coils are not energized, pistons *2* are in their extreme right-hand position. When the coil of electromagnetic valve *6* is energized, the valve connects the right end of the cylinder to the compressed air receiver. At this, the pistons remain in their right-hand position. When the coil of electromagnetic valve *5* is energized, the valve connects the left end of the cylinder to the atmosphere. Then pistons *2*, together with gear rack *3*, travel to their extreme left-hand position, rotating gear *4* and the drive shaft. By alternately energizing the coils of valves *5* and *6*, intermittent reversing rotation of the shaft can be obtained.

ELECTROHYDRAULIC DRIVE MECHANISM



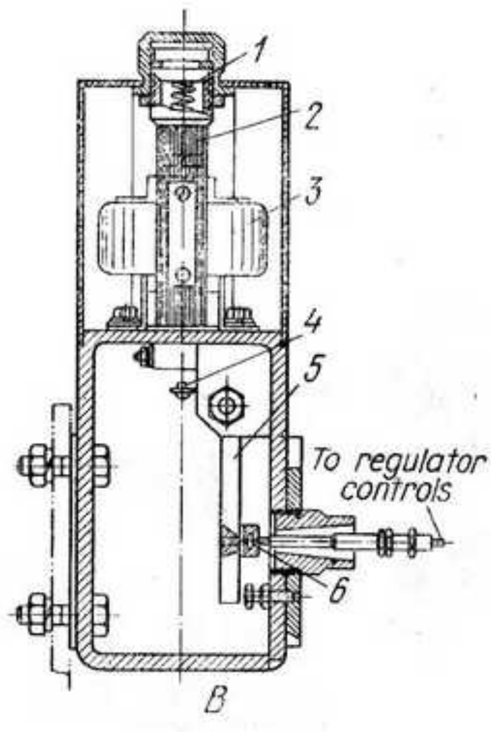
Linked to armature *2* of electromagnet *1* is valve spool *3*, which controls the fluid supply to hydraulic motor *4*. At the preset speed of electric motor *16*, the pulling force of electromagnet *1* is counterbalanced by the weight of spool *3* and the force exerted by spring *5*. Any variation in motor speed leads to a displacement of spool *3*, which admits fluid to one or the other side of vane *6* in hydraulic motor *4*. The fluid is delivered by continuously operating gear pump *7*. Rotation of vane *6* also rotates the slider of field rheostat *17*. The piston of damper *11* is linked to armature *2* through lever *9* and spring *10*. The shaft of vane *6* carries eccentric cam *12*, which actuates piston *13*. When the speed of electric motor *16* is reduced, the downward shift of spool *3* leads to clockwise rotation of vane *6* and, consequently, of cam *12*. The liquid compressed in space *14* by piston *13* leaks out slowly through needle flow-control valve *15*. As a result, displacement of piston *13* leads to displacement of piston *11* and spring *10* is compressed. The force of spring *10* is transmitted by lever *9* to armature *2*, forcing the armature to return to its initial position. This force is proportional to the speed of rotation of the shaft of hydraulic motor *4* and, consequently, to the velocity of the slider of field rheostat *17*.

RESHETOV ELECTROPNEUMATIC DRIVE MECHANISM



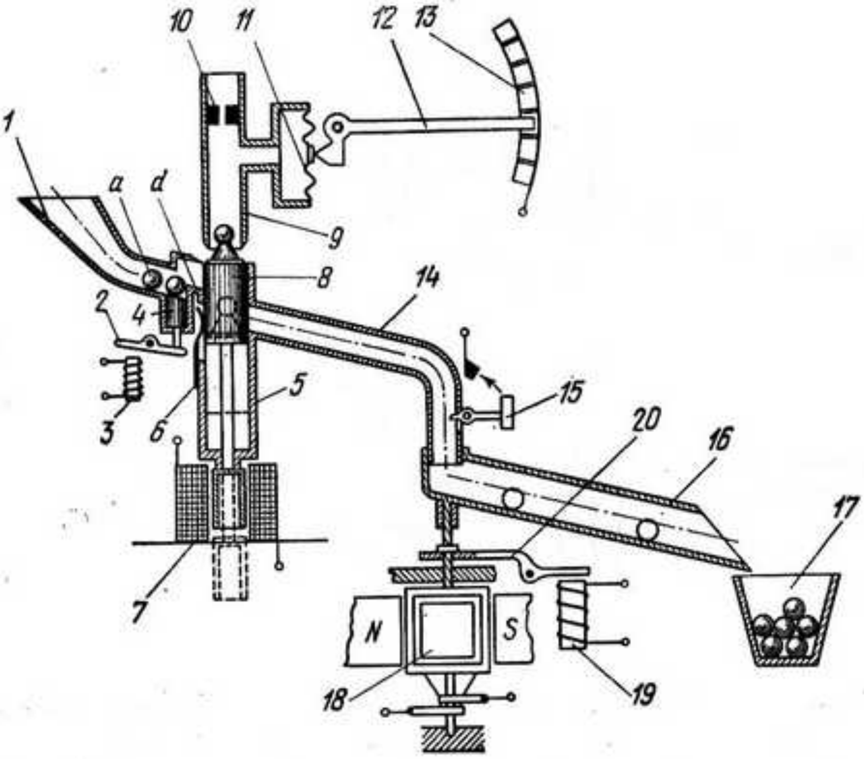
Cylinder *1* contains two pistons *2*, linked together by a rod consisting of two narrow longitudinal plates between which two rollers *3* are mounted. Shaft *a* runs in bearings of the housing and passes through slots in the narrow plates of the piston rod. Three-lobed cam *4* is rigidly mounted on shaft *a*, rotates about fixed axis *A* and is arranged between the narrow plates of the piston rod. Electromagnetic valves *5* and *6* are arranged at the two ends of cylinder *1* with the coils of the electromagnets connected into the control circuit. When neither coil is energized, the two valves connect both ends of the cylinder with the atmosphere. When the coil of left-hand valve *5* is energized, the valve member is shifted downward, connecting the left end of cylinder *1* with the compressed air tank. The compressed air shifts pistons *2* to the right so that left roller *3* turns cam *4* and shaft *a* clockwise. Rotation continues until left roller *3* reaches the recess between two lobes of the cam. At this, right roller *3* is slightly above the point of the third lobe. No further rotation occurs while the coil of left-hand valve continues to be energized. Cam *4* continues to rotate in the same direction (clockwise) when the coil of left-hand valve *5* is de-energized and that of right-hand valve *6* is energized to connect the right end of cylinder *1* to the compressed air tank and the left end to the atmosphere.

4726	SOLENOID DRIVE MECHANISM	CE Dr



Armature *2* is suspended from spring *1* and is normally in the upper position. When the winding of electromagnet *3* is energized, armature *2* is pulled downward. The lower end of the armature bears against flat spring *4*, turning lever *5* and deviating a jet valve nozzle by means of rod *6*. The jet valve nozzle is linked to the control mechanism of a regulator.

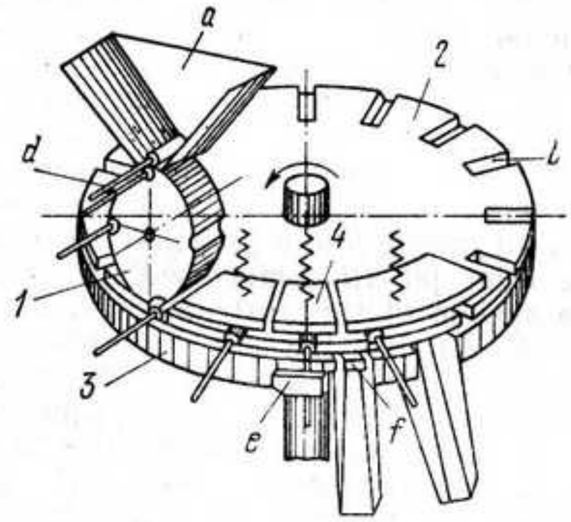
4727	AUTOMATIC ELECTROPNEUMATIC BALL SORTING MECHANISM	CE SF



4727	AUTOMATIC ELECTROPNEUMATIC BALL SORTING MECHANISM	CE SF

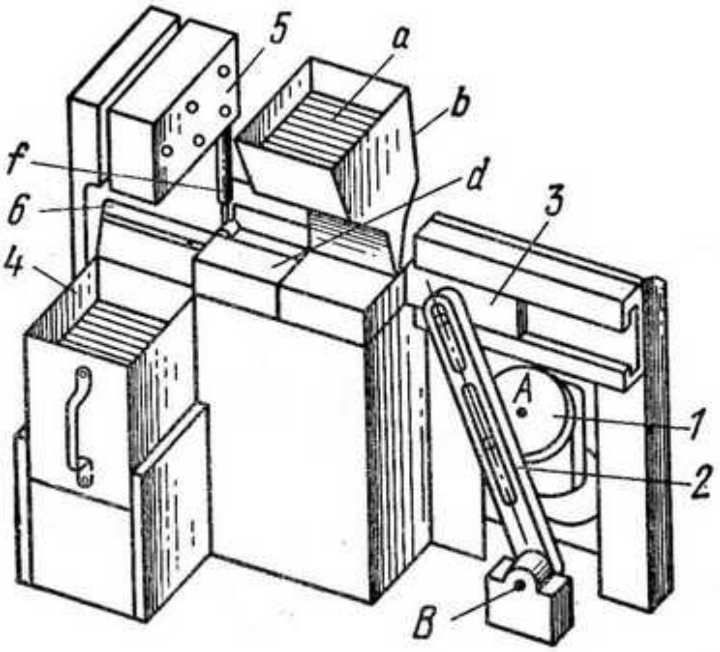
Balls *a* roll along tube *1* and are held up by step *d*. When the winding of electromagnet *3* is energized, armature *2* is pulled downward and pusher *4* lifts the ball so that it drops into tube *5* where it is stopped by flat spring *6*. When the winding of electromagnet *7* is energized, slider *8* shifts upward with the ball to its upper position in which the ball is measured. The ball is located by a recess in slider *8*. The ball being measured is advanced into output nozzle *9* of a pneumatic gauging instrument through whose inlet jet *10* compressed air is delivered. The pressure in the system of this instrument varies in accordance with the actual diameter of the ball. This pressure bends membrane *11* a corresponding amount to the right, turning bell-crank lever *12* along the series-connected contact plates of rheostat *13*. When measurement is completed, the winding of electromagnet. 7 is de-energized and slider *8* descends to its initial position. Flat spring *6* ejects the measured ball into tube *14*, where the ball turns lever *15*, closing contacts and thereby de-energizing the winding of electromagnet *3*. The measured ball drops into swivelling chute *16*, which turns to corresponding box *17* for balls of the given actual size range. The chute is turned by coil *18* which has a d-c supply through rheostat *13*. Depending upon the position of lever *12* (i.e. on the actual diameter of the ball), the current in coil *18* has a definite magnitude, as a result of which chute *16* turns through a definite angle, overcoming the resistance of a spiral spring. The coil and chute are locked in the required position by lever *20* and electromagnet *19*. The winding of this electromagnet is energized before measurement is completed to prevent the turning of the coil together with lever *12* after the pressure drop that occurs when measurement is completed.

4728	ELECTRIC-CONTACT NEEDLE INSPECTION AND SORTING MECHANISM	CE SF



The mechanism is intended for rejecting crooked sewing needles. From magazine *a* needles *d* drop into the slots of drum *1*, and from the drum into radial slots *b* of horizontal disk *2*. Disk *2* carries the needles away in its slots, with the needles sliding along stationary steel disk *3*, under disk *2*. From above, the needles are pressed against disk *3* by rubber segments *4*. Owing to the high coefficient of friction between needle *d* and rubber segment *4* and the low coefficient of friction between needle *d* and steel disk *3*, the needle is turned when it passes under insulated jaw *e*. If the needle is crooked, it contacts jaw *e*, closing an electric circuit for switching on a mechanism that opens shutter *f* of a hatch through which the crooked needle is ejected.

4729	INDUCTANCE-TYPE BAR INSPECTION AND SORTING MECHANISM	CE SF



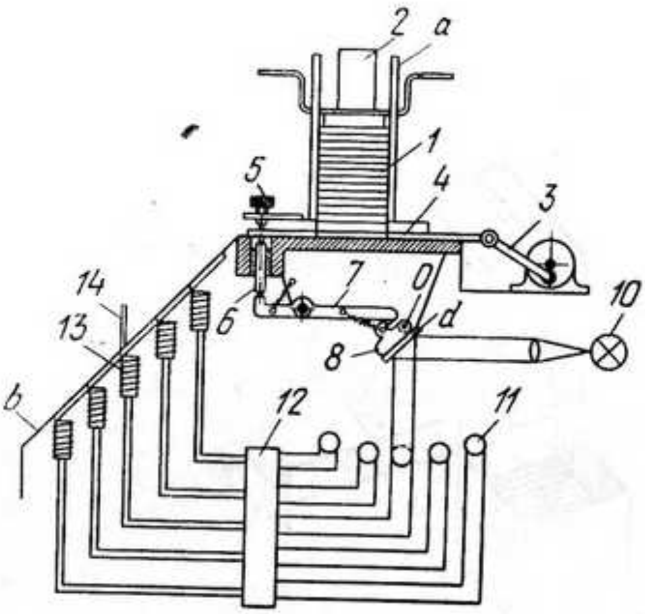
When crank 1 rotates about fixed axis A, slotted lever 2 oscillates about fixed axis B and reciprocates slider 3. A pusher, linked to slider 3, feeds bars a being inspected one by one from magazine to V-block d under measuring spindle f of electrical inductance inspecting device 5. According to the actual diameter of bar a, the corresponding electronic relay is tripped when it receives the current pulse from instrument 5. The relay controls shutter 6, positioning it according to results of measurement. When the pusher advances the next bar, the measured bar drops into corresponding sorting box 4.

4730

AUTOMATIC PHOTOELECTRIC PISTON-RING INSPECTION AND SORTING MECHANISM

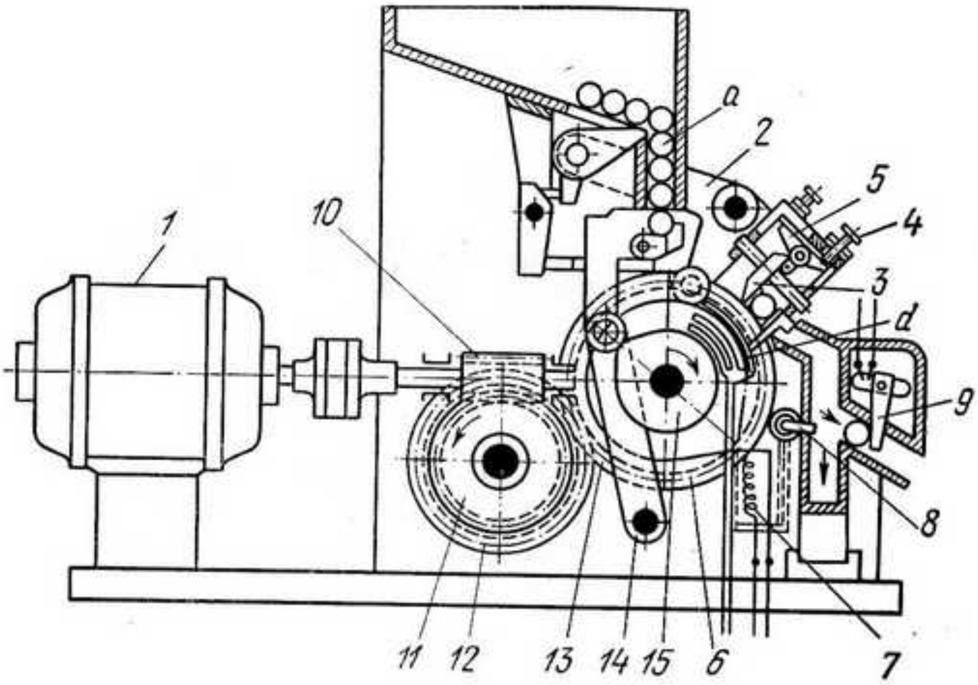
CE

SF



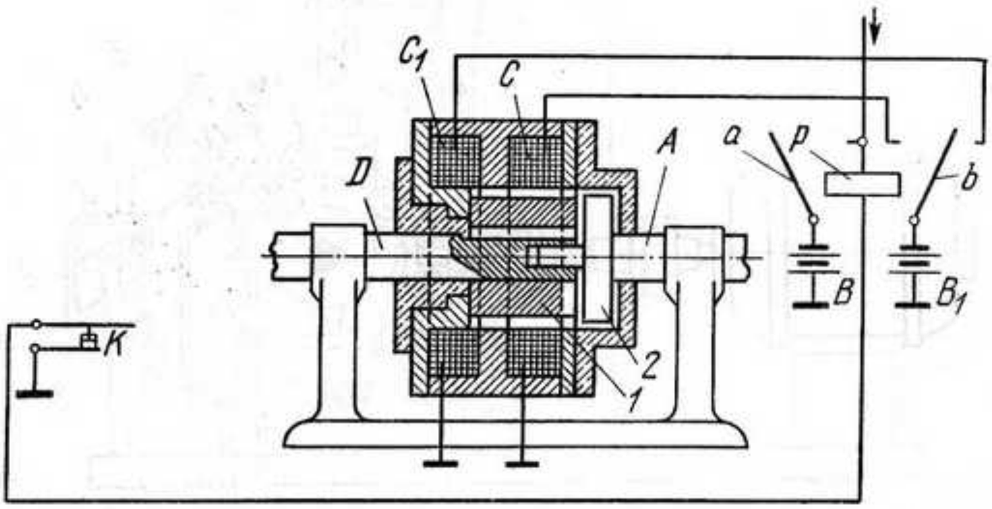
Piston rings *1* being inspected and sorted are stacked between guide posts *a* and are pressed downward by weight *2*. Connecting rod *3*, driven by an electric motor, reciprocates slide *4*. Lugs on the slide engage the rings one by one and push them between two measuring jaws, *5* and *6*. Upper jaw *5*, adjusted by a screw, is set in accordance with the ring thickness tolerance. Lower jaw *6*, linked to lever system *7* and *8*, is displaced with respect to the upper jaw by an amount corresponding to the actual thickness of ring *1* being inspected and sorted as it passes between jaws *5* and *6*. Mirror *d*, mounted on lever *8*, turns about fixed axis *O* to a position corresponding to that of jaw *6* in measuring ring *1*. A beam of light from source *10* is reflected from mirror *d* to one of five selenium photocells *11*. The current produced in the photocell is directed to amplifier *12*. According to the actual ring thickness, a definite photocell is illuminated and the winding of the corresponding electromagnet *13* is energized, operating the corresponding shutter *14*. This opens one of the holes in chute *b* onto which the measured ring is ejected, and the ring drops through the hole into the corresponding sorting box. In the case of a reject, the system fails to operate, all the holes remain closed, and the rejected ring slides down the chute into the reject box.

4731	AUTOMATIC ELECTROMAGNETIC WORKPIECE INSPECTION AND SORTING MECHANISM	CF SF



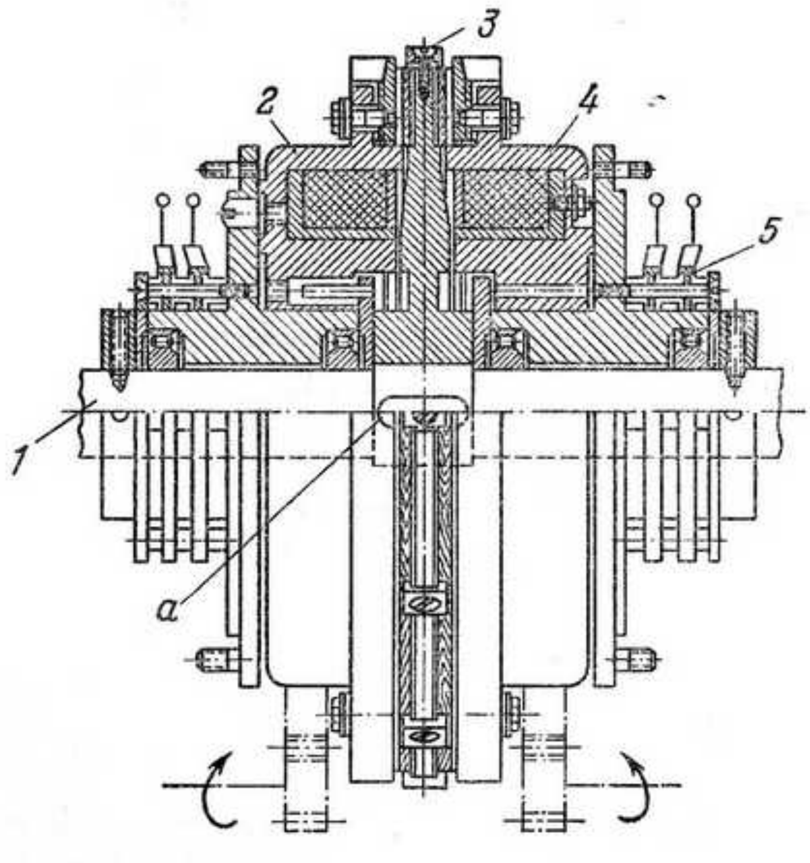
This mechanism is intended for checking the diameter and out-of-roundness of cylindrical workpieces, which require that the workpiece be turned in the process of inspection. Workpiece *a* is fed from a magazine to rotating drum *6*, which contains magnet *d* of segment shape. Drum *6* is driven by electric motor *1* through worm *10*, worm wheel *11*, and gears *12* and *13*. Rolling down on drum *6*, workpiece *a* is stopped by measuring jaws *3*, mounted on lever *2*. Owing to the action of magnetic segment *d* in rotating drum *6*, workpiece *a* is rotated between the jaws, displacing lever *5*, which makes contact with screws *4*. At the end of the inspection operation, lever *2* is raised and, in accordance with the results of measurement, electromagnet *7* turns shutters *8* and *9*, directing the workpiece to the corresponding chute. Feeding of workpiece *a* from the magazine is controlled by lever *14*, which is oscillated by cam *15*. Cam *15* turns together with drum *6*.

4732	ELECTROMAGNETIC CLUTCH MECHANISM	CE C



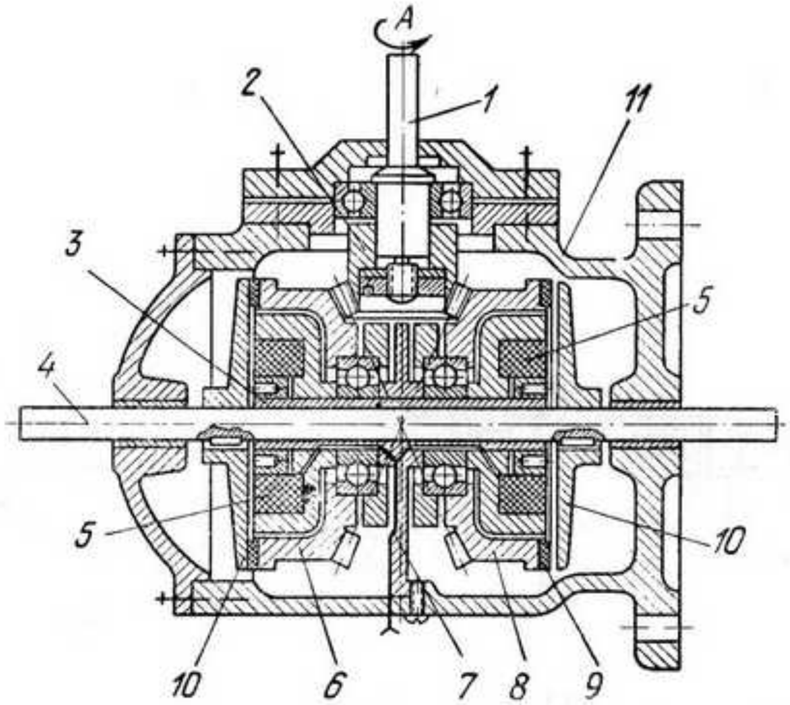
A current pulse trips starting relay p, attracting armatures a and b, and holding them due to the current from battery B through relay p and contact K to the earth. Current from battery B_1 energizes winding C. The magnetic flux set up by winding C slides cylindrical member *1* to the right along the shaft of the driven link, forcing it against disk *2*, which is rigidly mounted on driving shaft A. When disk *2* rotates, it drives shaft D. A cam on the shaft opens the circuit and switches off the relay. At this, current from battery B_1 energizes winding C_1. This disengages shaft D because cylindrical member *1* is pulled away from disk *2* and is shifted to the left.

4733	ELECTROMAGNETIC REVERSING CLUTCH MECHANISM	CE C



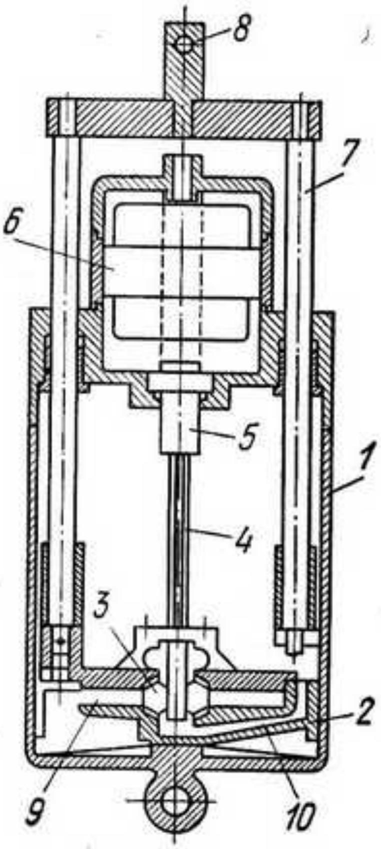
Electromagnets *2* and *4*, having exciting windings, rotate in opposite directions. Depending upon which of the windings is energized through contact rings *5*, armature *3*, which can slide along shaft *1* on feather key *a*, is attracted to either right-hand or left-hand electromagnet, *4* or *2*, thereby enabling the rotation of the shaft to be reversed.

4734	ELECTROMAGNETIC REVERSING CLUTCH MECHANISM	CE C



Shaft *1* rotates about fixed axis *A*. Bevel gear *2*, rigidly mounted on shaft *1*, meshes with hollow bevel gears *6* and *8*, which contain fixed electromagnets *5*. The housings of the electromagnets are rigidly mounted on common sleeve *3*, held against rotation by a partition 7, which is rigidly mounted in housing *11*. Armatures *10* slide along driven shaft *4* on feather keys. When the winding of one of electromagnets *5* is energized, corresponding armature *10* is attracted and held up against friction surface *9* on the end face of bevel gear *6* or *8* without touching stationary electromagnet *5*. At this, rotation of shaft *4* is engaged in the corresponding direction. When the winding of one electromagnet *5* is de-energized and the winding of the other electromagnet is energized, the direction of rotation of driven shaft *4* is reversed.

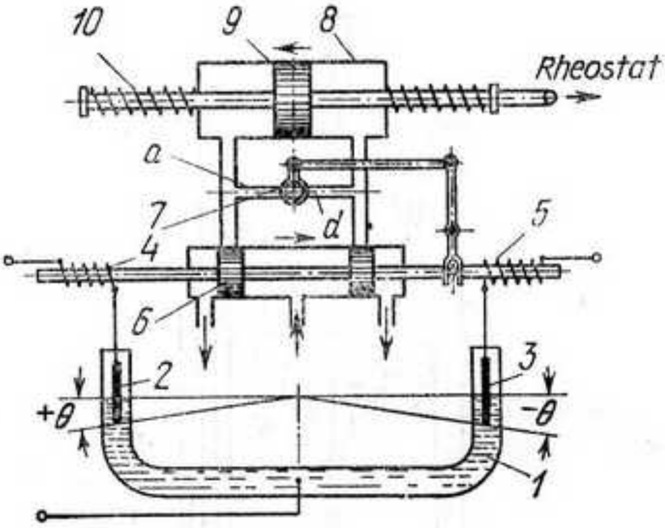
4735	ELECTROHYDRAULIC BRAKE ACTUATING MECHANISM	CE Br



Piston 2, linked to centrifugal pump 3, travels in cylinder 1, which is filled with a liquid. Through spline shaft 4, the impeller of pump 3 is linked to sleeve 5 of the shaft of electric motor 6, mounted on the cover of cylinder 1. When motor 6 is switched on, pump 3 delivers liquid from the upper end of cylinder 1 to the space under piston 2. This increases the pressure under the piston and it travels upward, raising columns 7 and crosspiece 8, which controls the brake shoes. When motor 6 is switched off, the pressure under piston 2 drops. Piston 2 is moved downward by a weight on the brake or by a spring (not shown) and returns to its initial position. At this, the liquid flows into the upper part of cylinder 1 through passages 9 and 10.

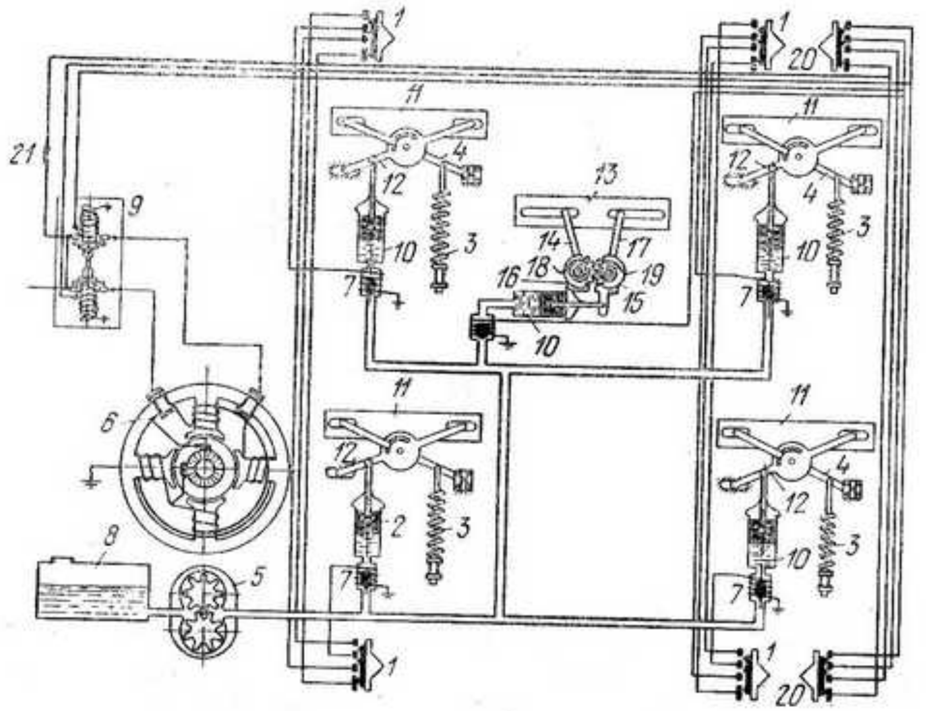
10. MECHANISMS OF OTHER FUNCTIONAL DEVICES (4736 through 4745)

4736	AUTOMATIC MERCURY-CONTACTOR COUNTERWEIGHT SHIFTING MECHANISM FOR A FLOATING CRANE	CE FD



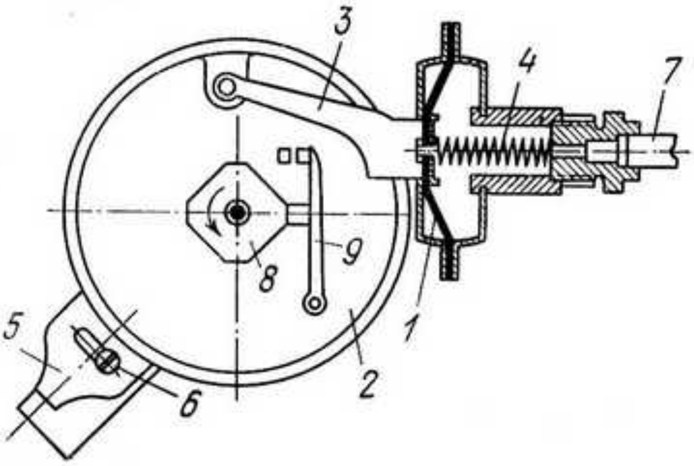
U-tube *1*, fastened to a transverse bulkhead inside a pontoon of the floating crane, is filled with mercury in which electrodes *2* and *3* are immersed. These electrodes are connected by leads to two coils, *4* and *5*, which are connected into the general circuit. A lead is also connected to the mercury at the bottom of tube *1*. When there is no roll or very little, the electrodes of both coils close circuits. Upon roll through a certain angle θ, exceeding the permissible value, the circuit of coil *4* is broken. Valve spool *6*, whose rods have ends which are cores of the coils, is shifted to the right. This turns rotary valve *7* and disconnects passages *a* and *d*. Fluid delivered by the pump to the valve of spool *6* is admitted to the right end of cylinder *8*, displacing piston *9* to the left. This switches on the starting rheostat (not shown) and an electric motor starts to shift the counterweight in the corresponding direction (to the left in the case considered) until the roll angle is reduced and electrode *2* closes the circuit of coil *4*. Coil *4*, being energized, shifts spool *6* back to the middle position and rotary valve *7* connects passages *a* and *d*. The compressed one of springs *10* returns piston *9* to its middle position. The action is similar upon roll in the opposite direction.

4737	ELECTROHYDRAULIC WINDOW-OPENER MECHANISM FOR AN AUTOMOBILE	CE FD



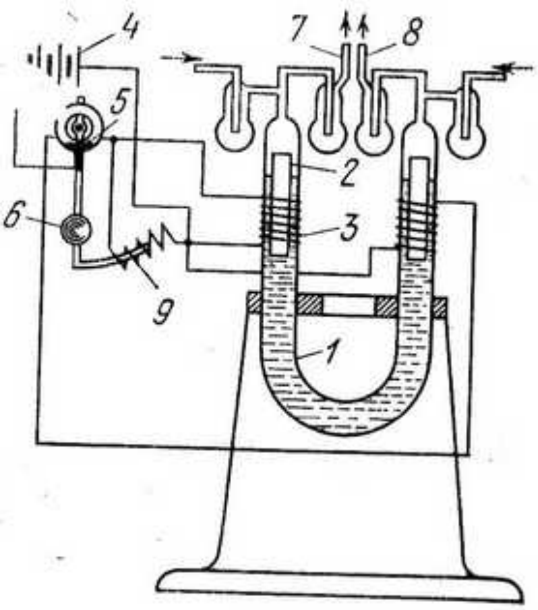
Gear pump *5*, driven by reversible electric motor *6*, pumps the brake fluid from tank *8* to the one of working cylinders *10*, or vice versa, whose electromagnetic valve *7*, admitting fluid to the particular cylinder, is opened by change-over switch *1*. When the thumbpiece of switch *1* is pushed upward, pump *5* delivers fluid to working cylinder *10* and raises window glass *11* by means of piston *2*, linked to a system of levers *4* and *12*, in the form of scissors, and overcoming the resistance of lowering spring *3*. When the thumbpiece of switch *1* is pushed downward, pump *5* pumps the fluid out from under piston *2*, and window glass *11* is lowered by powerful spring *3*. Partition window glass *13* is raised by two levers, *14* and *17*, by means of meshing gears *15* and *16* with spiral springs *18* and *19*. The raising and lowering of glass *13* is controlled from either of two switches *20*. Thermal bimetallic strip relay *21* and reversing and interlocking relay *9* are provided in the circuit for remotely switching motor *6* on in either direction to raise or lower the window glasses and to protect the system against simultaneously switching on motor *6* in both directions.

4738	VACUUM-OPERATED AUTOMATIC SPARK ADVANCE MECHANISM FOR ENGINE IGNITION	CE FD



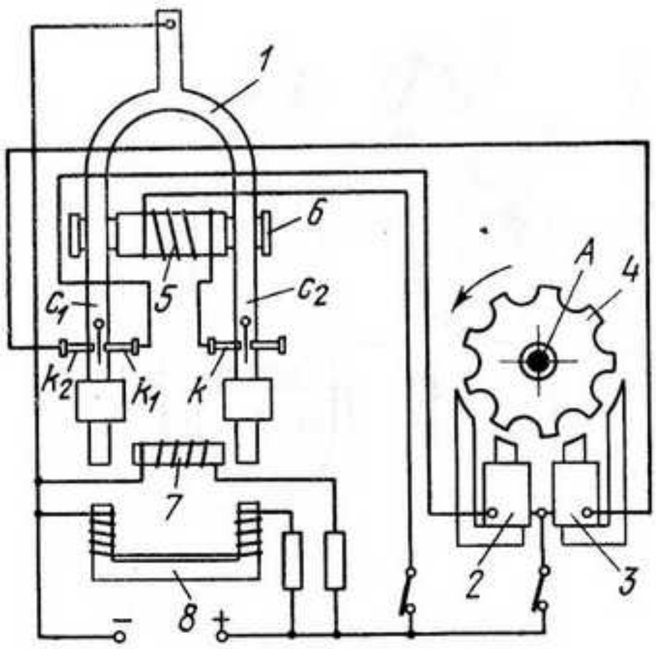
The mechanism serves to set the required angle of spark advance in the ignition in accordance with engine load as characterized by the degree the throttle valve of the carburettor is opened. When the throttle valve is completely open (maximum load), the vacuum in carburettor connection *7* is low and spring *4* bends diaphragm *1* to the left, turning disk *2* counterclockwise by means of lever *3*. Disk *2* is inside a housing and turns together with cam *8*. This turns lever *9* with its contact to the position for retarded ignition (sparking). When the throttle valve is closed to some extent, i.e. with a drop in the engine load, the vacuum in carburettor connection *7* increases, diaphragm *1* bends to the right, turning disk *2* toward a position of greater spark advance. The limits of spark advance are preset by means of lug *5*, rigidly attached to the housing and locked in a definite position by setscrew *6*. Operating in parallel with the vacuum-operated automatic spark advance device is an automatic centrifugal governor (not shown) which changes the firing point of the ignition in accordance with the change in the engine speed. The actual spark advance angle is the sum of the spark advance angles set up by each of these automatic devices.

4739	ELECTROMAGNETIC DOUBLE-ACTING FLOATING-PISTON GAS PUMP MECHANISM	CE FD



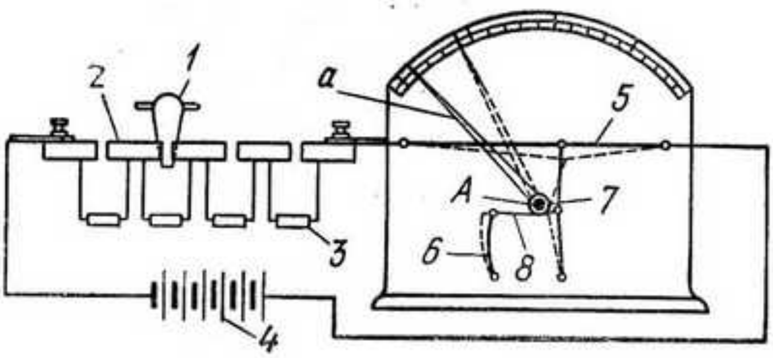
Two pistons *2* float in U-tube *1* filled with mercury. The pistons also operate as armatures reciprocating in the magnetic fields set up by windings *3*. These windings are alternately connected into the circuit of battery *4* by means of mercury contactor *5*, controlled by pendulum *6*. Contactor *5* alternately closes and opens the circuits of each coil *3*, energizing and de-energizing the coils. At this, armatures (floating pistons) *2* reciprocate vertically, imparting motion to the mercury in U-tube *1*. As a result, equal volumes of gas are pumped in the direction of the arrows through valves *7* and *8*. The oscillation of pendulum *6* is maintained by coil *9*, which is energized periodically by current from common battery *4*.

4740	ELECTROMAGNETIC TELEGRAPH APPARATUS VIBRATOR MECHANISM	CE FD



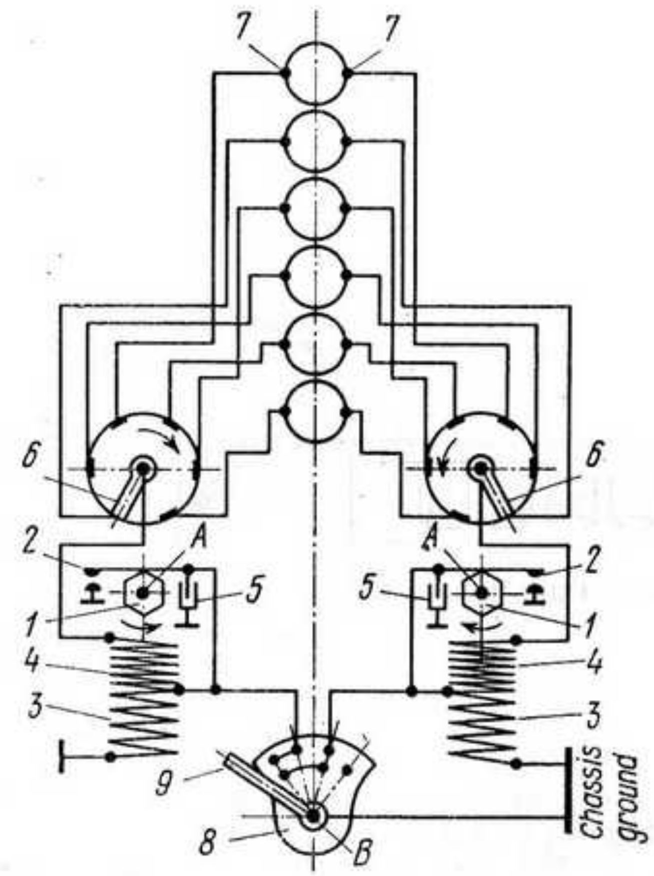
Vibrator *1* alternately closes and opens the circuits of electromagnets *2* and *3* of phonic wheel *4*, rotating about fixed axis *A*, thereby providing for uniform rotation of the wheel. Upon oscillation of the vibrator, its prong C_2 periodically closes its pair of contacts, closing a circuit that energizes the winding of electromagnet *5*. The current magnetizes core *6*, which attracts prongs C_1 and C_2, spreading them outward (away from each other). This opens the contacts at k, winding *5* is de-energized, the prongs move toward each other again, and the contacts at k are closed again. Thus, winding *5* is energized by an intermittent current, which oscillates the prongs of vibrator *1*. In its oscillation, prong C_1 alternately closes and opens the contacts at k_1 and k_2, alternately energizing and de-energizing the windings of electromagnets *2* and *3*, and imparting continuous rotation to phonic wheel *4*. Electromagnets *7* and *8* serve to regulate the frequency of oscillations of vibrator *1* within narrow limits.

4741	FLEXIBLE-LINK RESISTANCE BOX MECHANISM FOR AN ELECTRICAL INSTRUMENT	CE FD



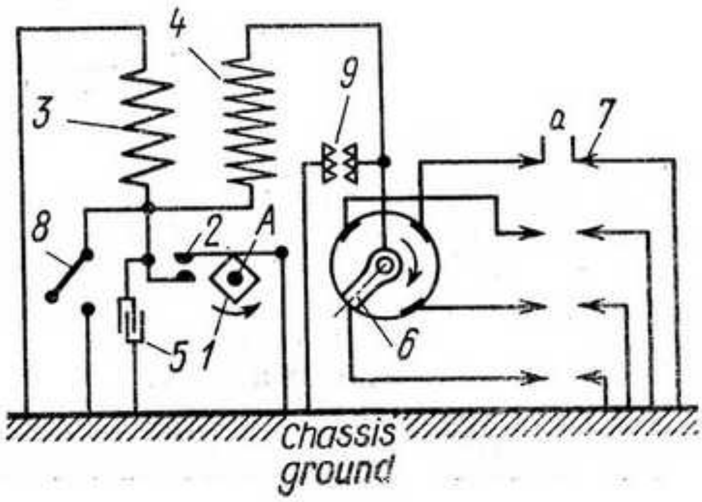
More or less resistors *3* can be disconnected from or connected into the circuit by inserting (or removing) plugs *1* into the sockets of plate *2* of the resistance box (plug rheostat). At a constant voltage of power source (battery) *4*, this change in resistance changes the current in the circuit. Varying with the current is the temperature of wire filament *5*, which has a high temperature coefficient of thermal expansion. As it becomes heated, filament *5* lengthens and is bent downward by spring *6*. As spring *6* moves to the left, it pulls silk thread *8*, which turns pulley *7*. Hand *a*, rigidly mounted on pulley *7*, is turned about fixed axis *A* by an amount that indicates the resistance connected into the circuit by the box.

4742	MAGNETO IGNITION MECHANISM OF A SIX-CYLINDER ENGINE	CE FD



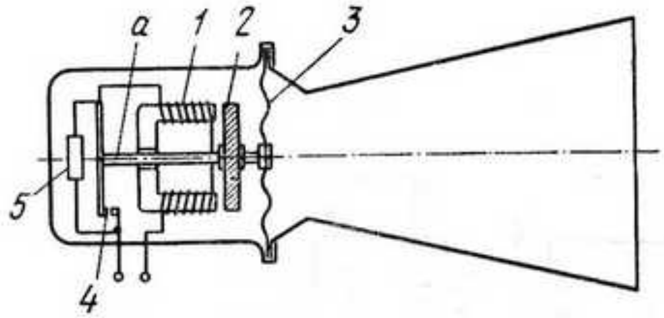
When cams *1* rotate about fixed axis *A*, current interrupters *2* are periodically opened, as a result of which an electromotive force (emf) is induced in primary and secondary windings, *3* and *4*, of the magneto armature (not shown). The intensity of this induction is raised by the provision of capacitors *5*. The emf is transmitted by current distributors *6* to the electrodes *7* of spark plugs, producing spark discharges that ignite the fuel mixture in the cylinders of the engine. Change-over switch *8* serves to switch both magnetos on or off, or each separately. Leads from the ends of the primary windings of the magnetos are connected to switch *8*. Handle *9* of the switch, turning about fixed axis *B*, can be indexed by a spring in four positions, providing for different combinations in which the ends of the primary windings are grounded to the chassis, or frame, of the automobile.

4743	MAGNETO IGNITION MECHANISM OF AN ENGINE	CE FD



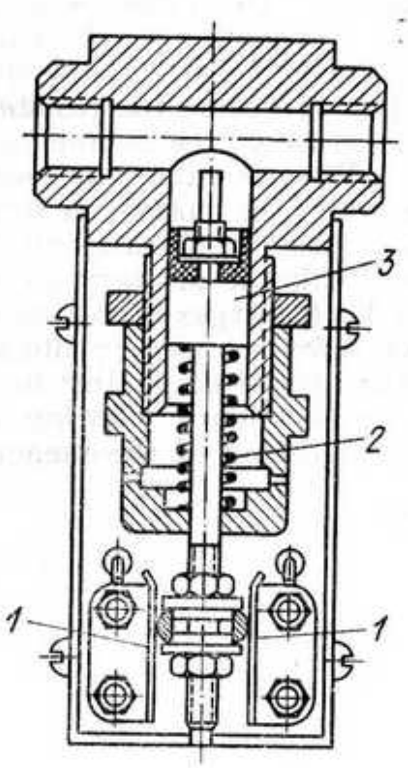
When cam *1* rotates about fixed axis *A*, current interrupter *2* is periodically opened, as a result of which an electromotive force (emf) is induced in primary and secondary windings, *3* and *4*, of the magneto armature (not shown). The intensity of this induction is raised by the provision of capacitor *5*. The emf is transmitted by current distributor *6* to electrodes *7* of the spark plugs, producing spark discharges that overcome the resistance of spark gaps *a* and ignite the fuel mixture in the engine cylinders. Switch *8* turns off the ignition. When switch *8* is closed, primary winding *3* is grounded directly to the chassis, or frame, of the automobile, bypassing interrupter *2*. As a result, the opening of the interrupter does not break the primary circuit, and an emf sufficient to initiate spark discharges is not induced in secondary winding *4*. A special safety device, protective spark gap *9*, is provided to protect the insulation against breakdown when the induced voltage in secondary winding *4* is considerably higher than in normal operation of the magneto.

4744	ELASTIC-LINK ELECTRIC AUDIBLE SIGNAL MECHANISM	CE FD



When the coil of electromagnet *1* is energized, armature *2* is attracted to the electromagnet, bending membrane *3* to the left and opening the contacts of interrupter *4* by means of rod *a*. Resistor *5*, connected in parallel with interrupter *4*, reduces the current in the winding of electromagnet *1* so much that armature *2* and membrane *3* return to their previous position owing to the elasticity of the membrane. This again closes the contacts of interrupter *4*, etc., leading to rapid oscillations of membrane *3*, producing the sound.

4745	PNEUMOELECTRIC LIMIT SWITCH MECHANISM	CE FD



The closing of control contacts *1* is accomplished by admitting compressed air above piston *3*. The contacts are opened by spring *2* when the air is switched off.

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